

Sudan University of Science and Technology

College of Graduate Studies

**Assessment of Amniotic Fluid Volume in Diabetic Pregnant
Women during the second and third trimesters using
ultrasound**

**تقييم حجم السائل الأمنيوسي للحامل المصابة بداء السكر في الطور الثاني و الثالث
من الحمل باستخدام الموجات فوق الصوتية**

A thesis submitted for Partial Fulfillment of the Requirement of
Ms.c degree in Diagnostic Medical Ultrasound

Presented By :

Sayda Mobarak Mohammed Eltahir

Supervisor :

Dr. Muna M. Ahmed Ali

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بسم الله الرحمن الرحيم

قال تعالى :

{ خَلَقَكُمْ مِنْ نَفْسٍ وَاحِدَةٍ ثُمَّ جَعَلَ مِنْهَا زَوْجَهَا وَآتَى لَكُمْ مِنَ الْأَنْعَامِ ثَمَانِيَةَ أَزْوَاجٍ يَتْلُوكُمْ
فِي بُطُونِ أُمَّهَاتِكُمْ خَلَقًا مِنْ بَعْدِ خَلْقٍ ظَلَمْتُمْ ثَلَاثَ نَكَاحَاتٍ لَكُمْ إِلَٰهُ رَبُّكُمْ لَهُ الْمُلْكُ لَا إِلَٰهَ
إِلَّا هُوَ فَأَنَّى تُصَوِّفُونَ }

صدق الله العظيم

(الاية 6 من سورة الزمر)

Dedication

To:

- ***My Mother***
- ***My father***
- ***My Colleagues***
- ***My friends***
- ***My staff***

Acknowledgment

I would like to thank Allah for the great help in preparing this research .

Special thank to Dr.Muna Ahmed for her great cooperation, guidance, encouragement and patience during all the stages of this research, from whom I understand that the life without knowledge mean nothing.

I generally indebted to thank my family for their helpful, special thank extended to my mother , my sister Tamador who always encourage and support me.

Also I would like to appreciate the helpful of my friends Mazahir , Durar and the staff of Elsoudy hospital.

Finally, I thank my husband for supporting me and being patience with me during preparing this research.

Sayda Mobarak.

Abstract

The objective of this study is to assess the amniotic fluid volume in diabetic pregnant women during the second and third trimesters and to identify the effect of diabetes mellitus on amniotic fluid volume .

Fifty diabetic pregnant women in the second and third trimesters which undergoing ultrasound exam in the department at Elskaikh Fadul and Elsoudy hospital at Ommdurman.

All diabetic pregnant women were in the second and third trimesters, and were scanned by (3.5 MH) convex probe , using (Sonoscape) machine.

Ultrasound assessment of amniotic fluid volume by measuring the amniotic fluid index referring to (Phelan method) and measuring the single vertical pocket referring to (Chamberlian method) .

The result showed that (13) noncontrolling diabetic pregnant women which was (26%) had polyhydramnios while (37) controlling diabetic pregnant women which was (74%) got an average amniotic fluid volume .

The main finding of the study was the polyhydramnios associated with noncontrolling diabetes that mean the diabetes mellitus had an effect on amniotic fluid volume .

This research showed that there was a strong correlation between the amniotic fluid volume and glucose level which indicated that the amniotic fluid volume increased as a result of increasing of glucose level directly.

Finally this study showed that the measurement of amniotic fluid volume by two methods using ultrasound and compare it with the type and status of diabetes play a great role in explaining the effects of diabetes mellitus on pregnancy.

ملخص الدراسة

الهدف من هذه الدراسة هو تقييم حجم السائل الامنيوني خلال الطور الثاني و الثالث من الحمل عند الحوامل المصابات بداء السكر و توضيح أثر السكر على السائل الأمنيوني.

تم فحص خمسين امرأة حامل مصابة بداء السكر بقسم الموجات فوق الصوتية بمستشفى الشيخ فضل و السعودي.

كل الحوامل كن في الطور الثاني والثالث للحمل وتم إجراء مسح لهن بواسطة مسبار محدب بتردد (3.5ميغاهيرتز) باستعمال ماكينة سونوسكيب.

تقييم الموجات فوق الصوتية لكمية السائل الأمنيوني بدليل السائل الأمنيوني (طريقة فلان) وقياس الجيب العمودي المنفرد (طريقة جامبرلين).

أوضحت النتيجة أن (13) امرأة حامل مصابة بداء السكر غير المسيطر عليه كانت نسبتهن (26%) وكانت كمية السائل الامنيوني لديهن زائدة عن الطبيعية بينما (37) امرأة حامل مصابة بداء السكر المسيطر عليه كانت نسبتهن (74%) وكانت كمية السائل الامنيوني لديهن طبيعية . هذا يعنى أن داء السكر يؤثر على كمية السائل الامنيوني .

البحث أوضح ان هناك علاقة قوية بين كمية السائل الامنيوني ومستوى السكر تشير إلى أن حجم السائل الامنيوني يزيد كنتيجة لزيادة مستوى السكر مباشرة.

Abbrevation

AFBS	Amniotic fluidband syndrome
AFI	Amniotic fluid index
AVF	Amnioticfluid volume
BRA	Bilateral renal agenesis
C.D.H	Congenital diaphragmetichernia
CN S	Central nervous system
DM	Diabetes mellitus
GDM	Gestational diabetes mellitus
GIT	Gastrointestinal tract
HbA1	Glycolatedhemoglobin
I.U.G.R	Intra uterine growth restriction
LMP	Last menstrual period
MCDA	Monochorionicdiamniotictwins
MVP	Maximum vertical pocket
Pt	Patient
SVP	Single vertical pocket
TAS	Transabdominalscanning
TEF	Tracheoesophagealfistula
UPJ	Uretropelvicjunction
PROM	Premature rupture of membrane
TTTS	Twin to twin transfusion syndrome

IDDM Insulin deppendantdiabetes mellitus

NIDDM Non insulindeppendantdiabetes mellitus

TOPS Twinoligo/polyhydramnios syndrome

MH Mega hertz

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Chapter one

Introduction

Chapter (one)

Introduction

1-1 Introduction

The amniotic fluid is a colourless liquid which surrounds the growing embryo and is produced from as early as (12 days) after conception by the cellular wall of the amniotic sac, during the first trimester it is mainly derived from the blood plasma that diffuses through the fetal tissues into the space surrounding it. (Dean 1992).

At about (20 weeks) the fetal kidney starts to function and fetal urine becomes the main source of amniotic fluid. (Dean 1992).

Other contribution comes from the fetal oral and nasal secretion and from the fetal surface of the placenta. (Dean 1992).

The amniotic fluid continuously replaces itself at a rate of every (3 hours) . Its volume gradually increases till (28-32 weeks) when it remains constant till (38-40) weeks. Then it decreases after term. (Dean 1992).

The amniotic fluid cushions the growing embryo and prevents skeletal defects. It keeps the fetus in constant temperature. The fetus breathes and swallows the fluid and this in the development of the lungs and gastrointestinal tract. It allows fetal movement and helps in the normal development of the musculoskeletal system. During labor it forms the fore water which helps in cervical dilatation and it protects the fetus and the umbilical cord against the strong uterine contractions . (Dean 1992) .

The amniotic fluid values can be more than the normal range and it known as polyhydramnios (1.5-2 L),or it can be less than the normal range and is known as oligohydramnios. (Dean 1992).

It is important to monitor amniotic fluid values because some of the causes of the abnormally high or low values can be avoided or managed e.g. control maternal diabetes or drugs that can affect fetal urinary output. (Dean 1992).

Sonography remains the method of choice for the assessment of amniotic fluid volume and is a great tool in diagnosing the reason for the abnormality. There are three methods for assessing amniotic fluid volume. (Dean 1992).

Subjective assessment is impossibly to standardize because it depends on the sonologist

Chamberlain or Single deepest pocket measures the largest vertical pocket of amniotic fluid, measurement range from (2-8cm) this has been used as a standalone test . (Dean 1992).

Phelan method or four quadrant amniotic fluid index, the uterus is divided into four compartments with the umbilicus being the centre. The largest vertical pocket is measured in each quadrant and these are added, the product ranges from (8-18) cm . (Dean 1992).

Diabetes mellitus is a medical disease that leads to hyperglycemia (an abnormal elevation of blood glucose level) and glucosuria , as the hyperglycemia increases .

Diabetes is made worse by pregnancy and increases the risk of pregnancy complications , there is an increased incidences in obese and lower socio-economic population. (Dean 1992).

An woman who develops diabetes during pregnancy or is discovered to have diabetes during pregnancy , this type is classified as gestational diabetes mellitus (GDM) .(Dean 1992).

When diabetic women receive optimal care prior to and during gestation ,the perinatal mortality rate is nearly equivalent to that observed in normal pregnancies , the higher incidence of perinatal mortality in women with pregestational or gestational diabetes has been related to poor control of diabetes during organogenesis at (10th menstrual week) . (Dean 1992)

1-2 The problem:

The number of women complain of diabetes mellitus increase recently, diabetes mellitus is increase the amniotic fluid of the fetus adversely, that increase the fetal morbidity and mortality.

Diabetes mellitus have consequence risks to both the mother and the fetus.

Ultrasound scanning is a more useful modality performed to lead to an accurate diagnostic informations and reduction of the fetal risks.

1-3 Objectives

1-3-1 General objectives:

To assess the amniotic fluid volume in diabetic women in the second and third trimesters by ultrasound.

1-3-2 Specific objectives:

To measure the amniotic fluid volume in the second and third trimesters of pregnancy in diabetic women , using the single vertical pocket and amniotic fluid index methods.

To assess the correlation between amniotic fluid volumes and diabetic status and diabetic type.

To assess the correlation between the amniotic fluid volumes and glucose level.

1-4 Overview :

Accordingly it divided in to the following chapters:

Chapter one: Introduction - Chapter two: Literature review-Chapter three: Methodology -

Chapter four: Result - Chapter five: Discussion, conclusion , recommendation,
references, data collecting sheet , appendix.

Chapter Two

Literature review

Chapter (two)

Literature review

2-1 Anatomy

2-1-1 Amnion and amniotic cavity:

The amnion is a membrane that closely covers the embryo. It fills with the amniotic fluid which causes the amnion to expand and become the amniotic sac, this fluid increases in quantity and causes the amnion to expand and ultimately to adhere to the inner surface of the chorion. The amnion and amniotic cavity emerge at about (day 22-23) last menstrual period or (8 day following conception). (Dean 1992).

The amniotic cavity initially, is small and lines one side of the embryo while the other side is lined with the yolk sac, then the amniotic cavity completely envelopes the embryo. (Dean 1992).

2-1-2 Amniotic fluid (liquor amnii):

Amniotic fluid also called (liquor amnii) is the clear liquid that surrounds the developing embryo (and later fetus). It is contained in the amniotic sac. about the fourth or fifth week amniotic fluid begins to accumulate within amniotic cavity.(Williams 2010).

It is firstly water-like fluid originates from the maternal plasma , it consists of desquamated fetal epithelial cells and approximately equal portions of organic and inorganic salts, in 98 - 99% water , and passes through the fetal membranes by osmotic and hydrostatic forces.(Dean 1992).

In the second trimester by about the (14th weeks) the liquid also contains proteins, carbohydrates , lipids and phospholipids and urea. The fetal kidneys begin to function in the second trimester and contribute fluid volume to the amniotic fluid and the baby will begin to breath and swallow the amniotic fluid. (Williams 2010).

As the placental and fetal vessels develop, the fluid passes through the fetal tissue of the skin. (Williams 2010).

In the third trimester and after (25th weeks) of pregnancy when the keratinization of skin occurs the composition of the amniotic fluid changes as fetal excreta (fetal urine, meconium) are added, the quantity of amniotic fluid begins to depend on the factors that comprise the circulation of amniotic fluid , fetal urinary output as a source of amniotic fluid becomes increasingly important as pregnancy advances.(Williams 2010).

2-1-3 The amniotic sac:

It is a thin but tough transparent pair of membranes, which hold a developing embryo (and later fetus) until shortly before birth. The inner membrane, the amnion, contains the amniotic fluid and the fetus. The outer membrane, the chorion, contains the amnion and is part of the placenta. (Dean 1992).

2-1-4 Chorion and chorionic cavity:

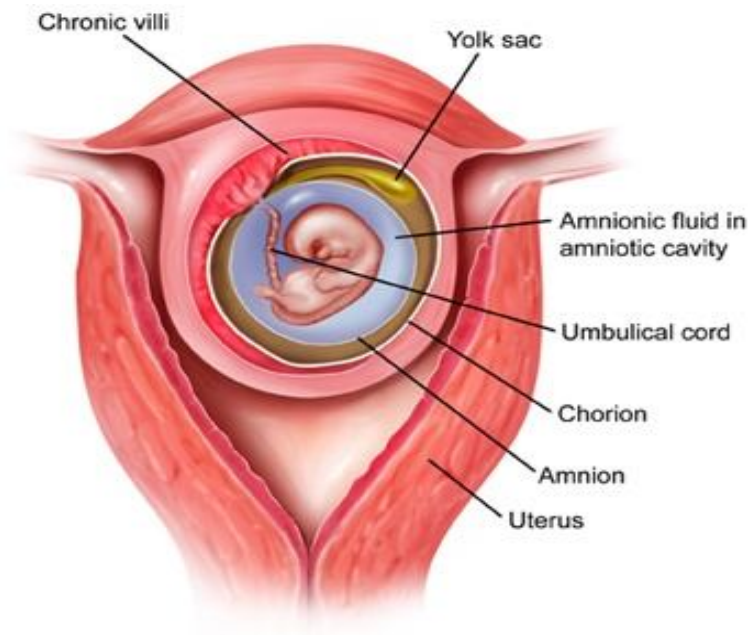
The chorionic cavity emerges by (day26 to 27) last menstrual period and grows rapidly with the production of chorionic fluid from the inner layer of cells lining the chorion. (Dean 1992).

The gestational (chorionic) sac contains the embryo, yolk sac, umbilical cord and amnion or amniotic membrane .(Dean 1992).

During early pregnancy, amniochorionic separation is developmental, whereas later in pregnancy it is pathologic and may be due to several conditions of variable significance and seriousness to pregnancy outcome .(Dean 1992).

The amniotic cavity expands at a faster rate than chorionic cavity resulting the amnion coming in contact with the chorion by about (9 weeks) last menstrual period and obliterating the chorionic cavity.(Dean 1992).

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) last menstrual period midterm.(Dean 1992).



Figure(2-1) Amniotic fluid

Show the amniotic fluid in the amniotic cavity chorion, amnion and yolk sac with in the uterus. (Bloom 2010).

2-2 Physiology

2-2-1 Fetal Urine:

The largest single source of amniotic fluid is fetal urine. The fetus begins to excrete urine by the end of the first trimester, it is estimated that about (500 ml) of fetal urine is added daily to the amniotic fluid. The fluid is 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 and continues to excrete it in ever-increasing volumes until term. (Dean 1992).

2-2-2 Lung Liquid:

Fetal lung liquid also plays a role in amniotic fluid formation, movement of amniotic fluid into the fetal lungs (respiration of amniotic fluid), demonstrated by the finding of meconium (aspiration) within the lungs of certain newborn indirect evidence confirms that lung liquid enters the amniotic cavity, based on the finding of surfactant within the amniotic fluid at term. (Elsevier 2007).

2-2-3 Fetal swallowing:

Fetal swallowing is the primary route by which amniotic fluid exits the amniotic cavity. 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 in to 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 in to 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 gastrointestinal tract, polyhydramnios will occur .(Dean 1992). 2-2-4

Intramembranous absorption:

This route of absorption involves direct absorption of amniotic fluid from the amniotic cavity in to blood within fetal vessels on the fetal surface of the placenta. (Elsevier2007).

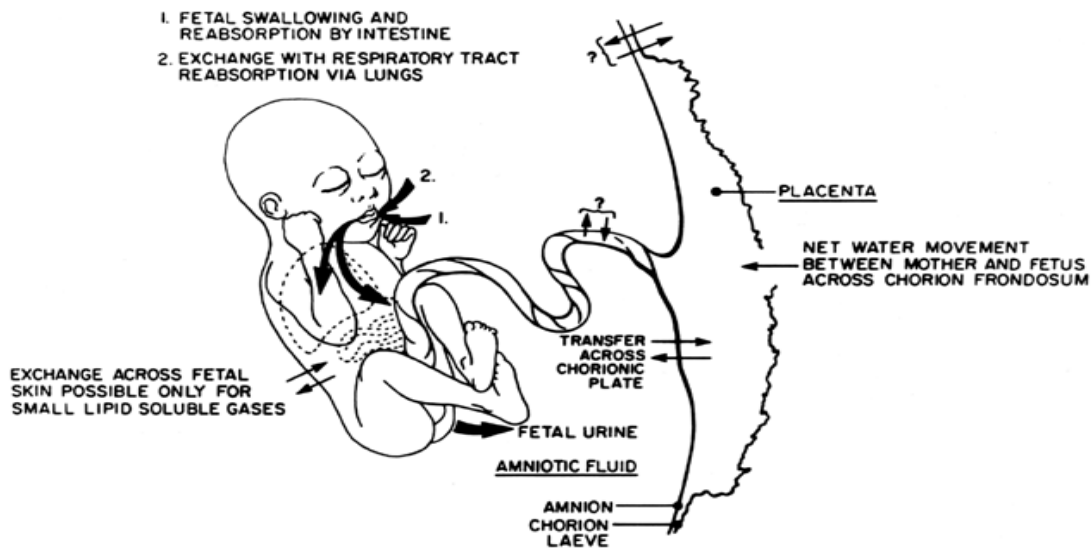


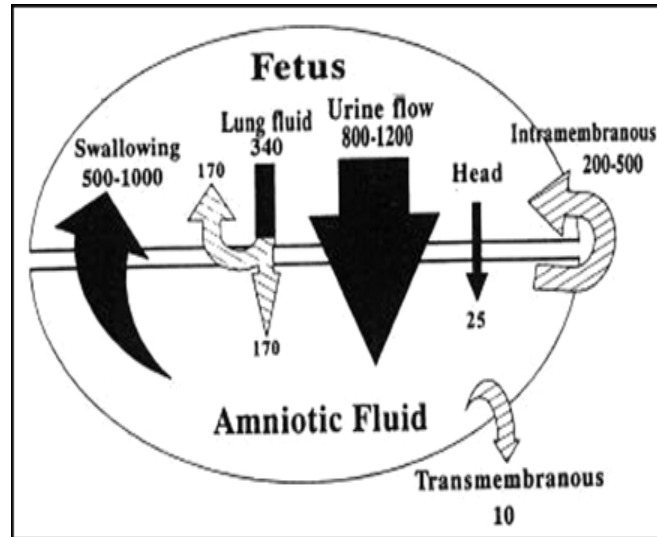
Figure (2-2)Amniotic fluid dynamics

Shows the dynamics of amniotic fluid such as fetal urine skin and across the lung and placenta , (Harper 1989)

2-2-5 Functions of amniotic fluid:

Helps with the uniform growth of the body parts and organs of the baby , assists with the proper bone and muscle development , allows the baby to move inside the uterus , prevents the amniotic sac wall from sticking to the baby , breathing in and out while in the uterus ensures proper lung growth of the baby, the swallowed fluid creates urine and helps with the production of meconium (earliest stools of a newborn infant) , allows the

digestive system of the baby to develop properly ,prevents the umbilical cord (responsible for carrying food and oxygen to the fetus) from being squeezed , maintaining a constant temperature to keep the baby healthy. (Elsevier 2007).



Figure(2-3) Amniotic fluid volume dynamics

Shows the numbers represent volume flow in mL/d. The curved portion of the double arrow represents lung fluid that is swallowed directly after leaving the trachea; the straight portion represents lung fluid that enters the amniotic cavity from the mouth and nose (Brace 1989).

2-2-6 Normal amniotic fluid volume:

Amniotic fluid volume is most predictable between (8 and 20 weeks) , when it correlates with fetal weight . This may relate to the predominant contribution of fetal skin dialysis to amniotic fluid volume . At (12 weeks') gestation, the average volume is (60 ml). By (16 weeks) , when genetic amniocentesis is often performed , the mean volume is (175 ml). From (20 weeks) there is a greater variance of amniotic fluid volume. It has been determined that amniotic fluid volume increases steadily throughout pregnancy to a maximum of (400–1200 ml) at (34–38 weeks) ; however, wide variation does exist , increase of amniotic fluid is only (5–10 ml/day) in the third trimester. After

(38 weeks), fluid volume declines by approximately (125 ml/week) , to an average volume of (800 ml) at (40 weeks). After (43 weeks), this volume is reduced to (250 ml). (Brace1989).

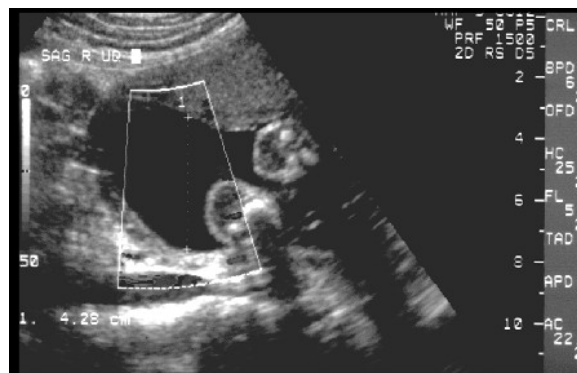
2-3Ultrasound assessment of amniotic fluid volume

2-3-1 Subjective assessment:

The fetus occupies less than half of the intrauterine volume until approximately (22 weeks) in the normal pregnancy. Thereafter the fetus progressively occupies a larger proportion of the intrauterine volume. This is a qualitative assessment of amniotic fluid volume and is therefore not standardized. Interobserver and intraobserver variability is reported to be very low. (Chauhan 2004)

2-3-2 Quantitative assessment:

2-3-2-a.Single deepest pocket measurement (Chamberlain method):



Figure(2-4) Single deepest pocket measurement

Shows normal amniotic fluid volume (4.2cm). (Magaan 1992).

Chamberlain , associates and others demonstrated that when the largest vertical pocket (LVP) was less than (1cm) , perinatal morbidity was increased, and when it was less than (90.5 cm) , the perinatal mortality rate increased. (Chauhan 2004).

Initial ultrasonographic estimation of amniotic fluid volume were made by measuring the largest vertical pocket (LVP) of amniotic fluid or the largest two-dimensional pockets of amniotic fluid. (Chauhan 2004).

2-3-2-b. Ultrasonographic estimation of amniotic fluid volume by measuring the largest vertical pocket:

(<1cm) = oligohydramnios

(1-2cm)= decreased fluid

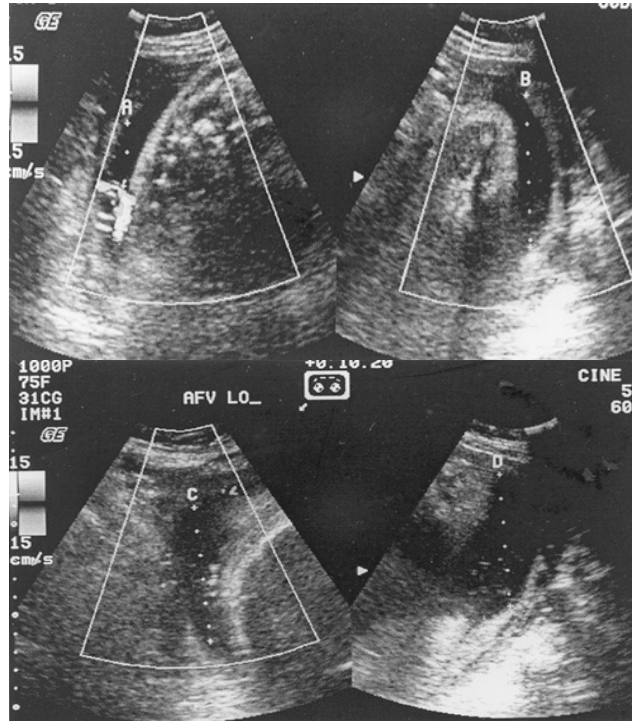
(2-8cm) = normal

(>8cm) = polyhydramnios.

Ultrasonographic estimation of amniotic fluid volume by measuring the largest vertical pocket .(Manning 1981).

2-3-2-c. Amniotic fluid index (AFI) (Phelan method):

By dividing the uterus into four quadrants and measuring the largest vertical pocket of amniotic fluid in each quadrant. The four values obtained are added together to produce an index of amniotic fluid volume. Values (between 8.1 cm and 18.0 cm) are considered normal. (Phelan 1987).



Figure(2-5) Amniotic fluid index

Shows A:Right-upper ,B:Left-upper,C: Right- lower , D:Leftt-lower quadrants. Anormal amniotic fluid index of (19.6 cm). Acolour box used to ensurean absence of intervening of umbilical cord.. (Magaan 1992).

2-4 Ultrasound technique of amniotic fluid index:

An ultrasound procedure used to assess the amount of amniotic fluid. The amniotic fluid index is measured by dividing the uterus into four imaginary quadrants . The linea nigras used to divide the uterus into right and left halves. The umbilicus serves as the dividing point for the upper and lower halves figure (2-6). (Manning 1981)



Figure (2-6) Ultrasound technique of Amniotic fluid index (AFI)

Shows umbilicus divide the uterus to upper and lower right and left halves to measure the amniotic fluid index. (Magann 2002).

The transducer is kept parallel to the patient's longitudinal axis and perpendicular to the floor. The deepest vertical pocket of fluid is measured in each quadrant in centimeters. The four pocket measurements are then added to calculate the amniotic fluid index. Normal amniotic fluid index values range from (5 to 25 cm). (Manning 1981).

There were some advantages of amniotic fluid index:

- 1-Easy to perform.
- 2- More subjective approach than amniotic fluid assessment.
- 3-Requires little training to perform and is ideally suited to real time ultrasound.
- 4-Provides a frame of reference for the inexperienced sonographer.
- 5-Gives a better assessment of amniotic fluid volume than does the single deepest pocket measurement, as the sum of all four quadrants correlate more closely with volume than by using a single measurement.(Dean 1992).

Table (2-1) Ultrasound estimation of amniotic fluid volume:

Shows ultrasound estimation of amniotic fluid volume (Dean 1992).

Ultrasound estimation of amniotic fluid volume			
Measurement technique	Oligohydramnios	Normal	Polyhydramnios
Amniotic fluid index	(0 to 5 cm)	(5.1 to 25 cm)	(> 25 cm)
Single deepest pocket	(0 to 2 cm)	(2.1 to 8 cm)	(> 8 cm)
Two-diameter pocket	(0 to 15 cm)	(15.1 to 50 cm)	(> 50 cm)

2-5 Pathology

2-5-1 Oligohydramnios:

Is the condition of having too little amniotic fluid .it is one of the common indications for antepartum testing at term and in the postdate period. It is in as many as (20 %) of high-risk pregnancies and frequently is related to the underlying maternal and fetal conditions. The definition of oligohydramnios from studies in which the true value was measured ranged from (200 to 500 mL) at term gestation. (Barckley1999).

Using ultrasonography to determine the deep vertical pocket, Chamberlain and associates found a (50-fold) increase in the perinatal mortality rate with a value of less than (1 cm.).the major drawback of the study was the co-diagnosis (40 %) of intrauterine growth restriction (IUGR) and other high-risk factors such as hypertensive disorders in the

mother, when oligohydramnios is diagnosed in the postdate period, there is an increased risk of meconium staining of the amniotic fluid , meconium aspiration syndrome, fetal distress in labor, and increased cesarean section rates.(Barckley1999).

With severe oligohydramnios in cases of intrauterine growth restriction or maternal hypertensive disorders, delivery often is indicated to decrease the perinatal mortality rate, generally, if the pregnancy is at(36 weeks) or more, the high risk of intrauterine loss may mandate delivery. (Barckley1999).

In preterm oligohydramnios ,when severe oligohydramnios occurs prior to term gestation, the perinatal mortality rate can approach (100 %). The indication for decreased or absent amniotic fluid was renal agenesis, marked intrauterine growth restriction usually predicts survival . Table (2-1) list many of the causes of oligohydramnios from either maternal or fetal condition. When a pregnant patient presents with markedly reduced or absent amniotic fluid in mid-gestation, an evaluation for ruptured membranes should be performed in addition to detailed ultrasonography for diagnosis fetal abnormalities .Oligohydramnios often was considered a diagnosis if the uterus measured small for gestational age or if the fetus could be palpated easily. (Barckley1999).

Table (2-2) Fetal and maternal causes of oligohydramnios(Dean 1992).

Fetal conditions • intrauterine growth restriction • Spontaneous rupture of the membranes • Premature rupture of the membranes • Abnormal placentation • Renal agenesis or • Obstructed uropathy • Postmaturity syndrome
Maternal conditions • Antiphospholipid syndrome • Dehydration – hypovolemia • Hypertensive disorders • Uteroplacental insufficiency

2-5-3Birth defects:

Problems with the development of the kidneys or urinary tract which could cause little urine production, leading to low levels of amniotic fluid involves:

2-5-3-a. Bilateral renal agenesis (BRA):

Bilateral renal agenesis or (Potter syndrome) , is a lethal abnormality characterized by congenital absence of both kidneys and severe oligohydramnios. The reported incidence of bilateral renal a genesisis about (1 in 4,000) births. Neonatal mortality is attributable to severe pulmonary hypoplasia due to severe oligohydramnios . (Dean 1992).

2-5-3-b. Bilateral uretropic junction obstruction:

Bilateral uretropic junction obstruction is associated with variable degrees of oligohydramnios and a variable prognosis depending on the severity and duration of renal obstruction . (Dean 1992).

With bilateral uretropic junction obstruction, there is variable severity of oligohydramnios and depending on the severity and duration of the urinary obstruction. (Dean 1992).

2-5-3-c. Posterior urethral valves:

The most common cause for urinary obstruction at the urethral level, the most specific sonographic finding is the “keyhole sign” which describes a dilated urinary bladder with a dilated proximal urethra ; the bladder wall may appear abnormally thickened, and there may be bilateral , hydroureters and hydronephrosis. Oligohydramnios may be mild to severe depending on the degree of obstruction.(Dean 1992).

2-5-3-d. Urethral atresia:

Urethral atresia is the second most common cause of urethral level obstruction and causes the most severe form of urinary obstruction since fetal urine is unable to pass into the amniotic fluid. Typical sonographic findings include megacystitis associated with anhydramnios (no detectable amniotic fluid). (Dean 1992).

In most cases, oligohydramnios and renal abnormalities are evident by (24 to 26) weeks gestation . (Dean 1992).

2-5-3-e. Pulmonary hypoplasia:

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 (much of the perinatal mortality in pregnancies complicated with severe oligohydramnios is due to fetal pulmonary hypoplasia). (Dean 1992).

Fetal complications related to chronic fetal hypoxia and stress is also a major contributing factor to perinatal mortality in pregnancies complicated with oligohydramnios. (Dean 1992).

2-5-3-f. Placental problems:

If the placenta is not providing enough blood and nutrients to the baby, then the baby may stop recycling fluid. (Dean 1992).

2-5-3-g. Leaking or rupture of membranes:

This may be a gush of fluid or a slow constant trickle of fluid. This is due to a tear in the membrane. Premature rupture of membranes (PROM) can also result in low amniotic fluid levels. (Dean 1992).

The main concern is chorioamnionitis , if the patient has ruptured membranes for longer than (24 hours), with or without labour, chorioamnionitis may cause fetal death, and maternal death. (Dean 1992).

If the pregnancy is less than (32 weeks) gestation, the pregnancy is usually allowed to continue under very close assessment because the fetus is immature and at high risk for neonatal respiratory distress syndrome. (Dean 1992).

If the pregnancy is greater than (32 weeks) , labour may be induced or cesarean section may be performed depending on several factors. (Dean 1992).

2-5-3-h. Post date pregnancy:

A post date pregnancy (one that goes over 42 weeks) can have low levels of amniotic fluid, which could be a result of declining placental function.(Dean 1992).

2-5-3-k. Maternal complications:

Factors such as maternal dehydration, hypertension , preeclampsia ,diabetes , and chronic hypoxia can have an effect on amniotic fluid levels. (Dean 1992).

2-5-4 The risks of oligohydramnios:

The risks associated with oligohydramnios often depend on the gestation of the pregnancy. The amniotic fluid is essential for the development of muscles, limbs, lungs, and the digestive system. In the second trimester, the baby begins to breathe and swallow the fluid to help their lungs grow and mature. The amniotic fluid also helps the baby develop muscles and limbs by providing plenty of room to move around. (Dean 1992).If oligohydramnios is detected in the first half of pregnancy, the complications can be more serious and include:

- Compression of fetal organs resulting in birth defects
- Increased chance of miscarriage or stillbirth

If oligohydramnios detected in the second half of pregnancy, complications can include:

- Intrauterine growth restriction (IUGR), oligohydramnios associates with intrauterine growth restriction, a fetus whose estimated weight is below the 10th percentile for its gestational age and whose abdominal circumference is below the (2.5th) percentile.
- Preterm birth

Labour complications such as cord compression , meconium stained fluid and cesarean delivery. (Dean 1992).

2-5-5 Amniotic fluid band syndrome (AFBS):

Is the result of early rupture of the amnion allowing the fetus to come in direct contact with the chorionic side of the amnion which is "sticky" and affects normal embryonic development. (Dean 1992).

Amniotic rupture in the first weeks of pregnancy results in craniofacial, spinal, and visceral defects, whereas during the second trimester, it may lead to limb constriction and amputation. Multiple anomalies are present three quarters of the time. (Dean 1992).

2-5-6 Polyhydramnios:

Polyhydramnios is the condition of having too much amniotic fluid in the amniotic sac or it is (An excessive amount of amniotic fluid). (Williams1987).

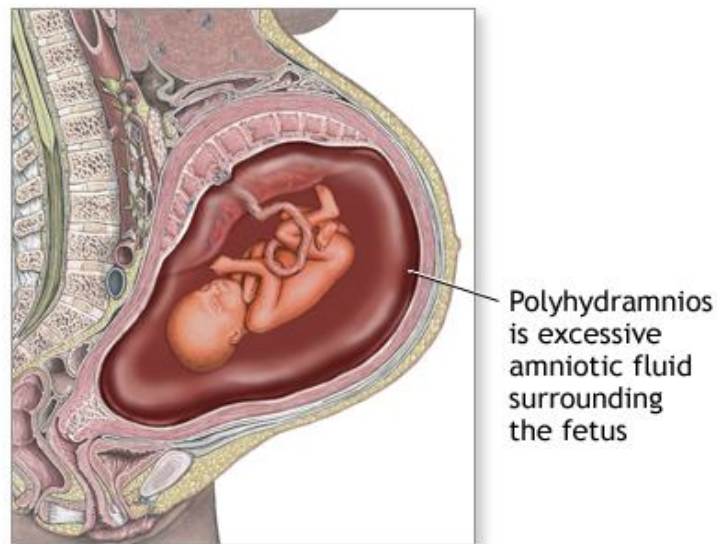


Figure (2-7) polyhydramnios

Showed a fetus with polyhydramnios. (Hashimoto 1986).

Polyhydramnios divided in to two:

2-5-6-a.Acute polyhydramnios :

Where excess amniotic fluid collects rapidly, however its onset may be cause sudden distention of the uterus . (Williams1987).

2-5-6-b.Chronic polyhydramnios:

Where excess amniotic fluid accumulates most frequently gradually, it associate with difficulty in palpating fetal small parts and in hearing fetal heart tones, the uterine wall may be so tense that the obstetrician cannot palpate any part of the fetus. (Williams1987).

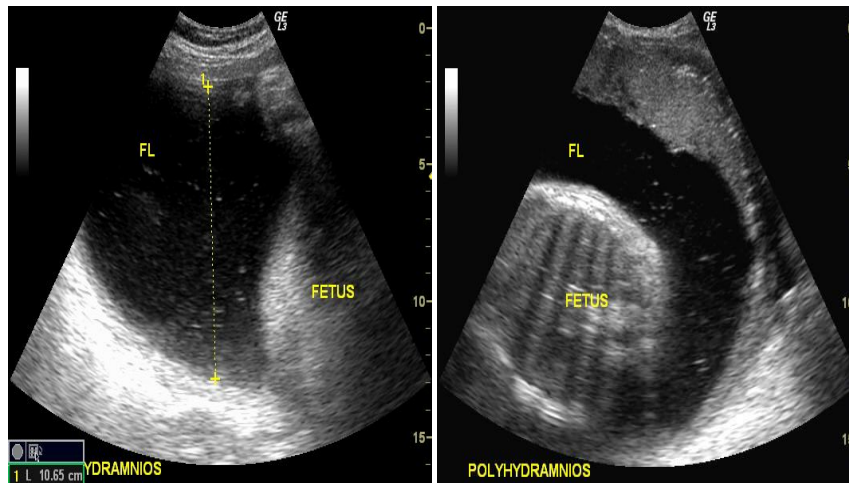


Figure (2-8) polyhydramnios

The above ultrasound images show excess amniotic fluid (the largest single pocket measuring (11 cms). Approximately . This suggests mild to moderate polyhydramnios. Particulate matter seen in the fluid is due to fetal meconium. (Hashimoto 1986).

Previously, polyhydramnios was diagnosed when the uterus was large for gestational age or the fetus could not be easily palpated by Leopold maneuvers. The diagnosis was either confirmed or refuted by the amniotic fluid volume at the time of delivery. Like oligohydramnios, polyhydramnios can result in a marked increase in perinatal morbidity and mortality, depending on the amniotic fluid volume, the presence of other fetal or placental abnormalities, and when in gestation it occurs. (Dean 1992).

Severe polyhydramnios in mid-gestation usually is associated with congenital malformations. (Dean 1992).

2-6 Ultrasonography:

Transabdominal scanning is performed by placing the transducer in contact with the skin just above the symphysis pubis. Transabdominal scanning study is generally performed with the patient in asupine position. (Dean 1992).

Ultrasound is an excellent, non invasive imaging modality, frequently used in diagnosis of amniotic fluid volume, also it play a role in follow up evaluation and management of Abnormal amniotic fluid volume. (Dean 1992).

Ultrasound is routinely employed in monitoring of fetal growth and age and compare that with amniotic fluid volume. (Dean 1992).

Ultrasound has been used to measure or estimate amniotic fluid volume. Initial attempts employing the deep vertical pocket reported a value of greater than (8 cm) as representing polyhydramnios, figure (2-8) above .These investigators categorized patients who had polyhydramnios into three groups:

Measurements of polyhydramnios by deep vertical pocket (DVP):

Mild: (DVP 8 to 11 cm) (79 %) of cases).

Moderate : (DVP 12 to 15 cm) (16.5 % cases).

Sever: (DVP 16+ cm) (5 % of cases). (Chauhan 1997)

Chamberlain and colleagues arbitrarily defined polyhydramnios as a fluid pocket of at least (8 cm) in vertical and transverse diameters. Using this criterion, the incidence of polyhydramnios in a select high-risk referral population was (3.2%).With the increased clinical use of the amniotic fluid index compared with the deep vertical pocket, investigators began to study amniotic fluid index. Moore and Cayle reported the amniotic fluid index across gestation, concluding that the amniotic fluid index must be referenced to gestational age figure (2-9). The upper limit of normal for the amniotic fluid index at

any point in gestation occurred at (35 weeks) of gestation and was (27.3cm). this value clearly would be abnormal earlier or later in gestation.(Manning 1981)).

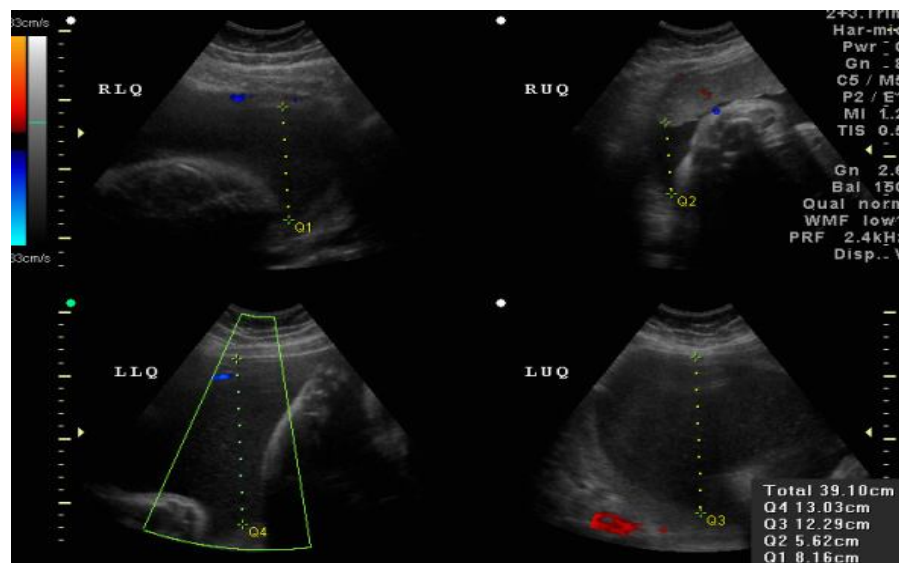


Figure (2-9) polyhydramnios

This image show an amniotic fluid index of (39.10cm), indicating polyhydramnios.

01/(RLQ)=(8.16cm).

02/(RUQ)=(5.62cm).

03/(LUQ)=(12.29cm).

04/(LLQ)=(13.03cm).(Goldstein 1988).

2-6-1.Transducer preparation and care:

There is no special transducer preparation prior to performing atransabdominal scans, however it should be clean and electrically safe to operate, e.g. cable should not be frayed.

(Dean 1992).

Acopious amount of scanning gel is applied to the transducer tip to ensure good transducer skin contact and easy movement of the transducer. Desirable properties of

ultrasound gel include water solubility, non staining, hypoallergenicity, and good sound conductivity.

Gel should be mechanically wiped off the transducer at the end of every study. It is also advisable to clean the transducer with soap and water (cleansing solution in a spray bottle such as hydrox) or (70%) alcohol wipe between patients to reduce the risk of cross-infection from skin flora which has been shown to occur from patient to patient during abdominal ultrasound examination. (Dean 1992).

2-6-2. Transducer manipulations:

The basic transabdominal scanning transducer manipulations are sliding, rocking, tilting, rotating, and compression. (Dean 1992).

2-7 The maternal signs and symptoms of polyhydramnios:

Are usually caused by the over distended uterus and its compressing effect on intrathoracic and intra-abdominal organs. Elevation of the diaphragm can result in dyspnea and occasionally respiratory distress. (Cardwell 1987).

2-8 Complications of high fluid level:

1. Premature rupture of the membranes (PROM) .
- 2 . Placental abruption .
4. Preterm labor and delivery (approximately 26%) .
5. Intrauterine growth restriction (IUGR) resulting in skeletal malformations .
6. Stillbirth .
7. Cesarean delivery .
8. Postpartum hemorrhage . (Dean 1992).

Table (2-3)Risks of polyhydramnios

Maternal conditions	Isoimmunization
	Diabetes mellitus
Placental conditions	Chorioangioma
	Circumvallate placenta
Fetal conditions	
Multiple gestations	Twin-to-twin transfusion syndrome
Gastrointestinal	Esophageal atresia, duodenal or jejunal atresia, diaphragmatic hernia, omphalocele, gastroschisis
Central nervous system	Anencephaly, hydrocephalus, encephalocele, spina bifida, microcephaly, hydranencephaly
Skeletal malformations	osteogenesisimperfecta
Fetal tumors	Cystic adenomatoid malformation of the lung
Cardiac disease	Severe congenital heart disease
Genetic disorders	Down syndrome, trisomy 13 and 18, multiple congenital anomalies
Fetal renal and endocrine disorders	Infertile polycystic kidney disease

Shows risk factors for polyhydramnios may be broadly divided into maternal, fetal, placental and idiopathic origins (Cardwell1987).

2-9-Congenital anomalies:

2-9-1-Esophageal atresia:

Is a congenital absence of a segment of the esophagus. it is most often accompanied by a tracheoesophageal fistula (TEF). (Dean 1992).

Esophageal atresia should be suspected when an empty or small fetal stomach is seen in the presence of polyhydramnios. (Dean 1992).

2-9-2-Duodenal atresia:

It suggesting that the fetus is unable to swallow a sufficient volume of amniotic fluid for bowel dilation. (Dean 1992).

Prenatal diagnosis is based on the demonstration of the characteristic “double bubble sign” appearance of the dilated stomach and proximal duodenum, commonly associated with polyhydramnios and trisomy 21 or Down’s syndrome . (Dean 1992).

The diagnosis of duodenal stenosis or obstruction can usually not be made prior to about (24 weeks) since the duodenum or stomach may not be abnormally dilated before this time . (Dean 1992).

2-9-3-Enlarged stomach:

Abnormal gastric dilatation is most commonly seen in association with duodenal atresia. (Dean 1992).

The sonographic manifestations of gastric outlet, duodenal, or other bowel obstruction are usually not evident until the third trimester. (Dean 1992).

Diagnosis of gastric outlet obstruction in the second trimester should be suspected and the patient re-evaluated if the stomach appears unusually large, especially if there is evidence of polyhydramnios).The size of the stomach varies considerably depending on gestational age and how much amniotic fluid has been recently swallowed by the fetus. (Dean 1992).

2-9-4-Congenital diaphragmatic hernia(CDH):

Is the presence of abdominal viscera in the thoracic cavity due to a congenital defect in the diaphragm. The size of the defect varies from a tiny opening to complete absence of the hemidiaphragm .(Dean 1992).

The sonographic finding associated with congenital diaphragmatic hernia is typically mild or intermittent polyhydramnios in the second trimester .(Dean 1992).

Bowel obstruction appears as abnormally dilated, fluid-filled loops of bowel. one may observe increased peristalsis during real-time evaluation and the presence of floating particles in the abnormal bowel loops. (Dean 1992).

Polyhydramnios is a common feature of high level intestinal obstruction (duodenal to mid-jejunum). (Dean 1992).

2-9-5-Twin to twin transfusion syndrome(TTTS):

In many monochorionicdiamniotic (MCDA) twin gestations, one twin will experience significant polyhydramnios where as the other will be immobilized or “stuck” in an oligohydramniotic sac. (Barckley1999).

This finding is referred to as the stuck twin sign .The oligohydramnios may be so severe.The combined presence of same sex twins, a single placenta with a thin separating membrane, weight discordance of 20% or more of the larger twin ,and a major difference in fluid volume between amniotic sacs has been termed oligohydramnios/polyhydramnios sequence (TOPS).(Barckley1999).

The recipient twin will increase the urine , resulting in having a very large bladder. As the disease progresses, the donor will produce so little urine that its bladder may not be seen on ultrasound. Often the polyhydramnios of the recipient twin is the first thing noticed by the patient due a sudden increase in the size of the uterus. At other times the differences in the amniotic fluid volumes between the twins is only noticed at the time of a routine ultrasound. (Barckley1999).

The recipient fetus is larger, hypervolemic, cardiac overloaded, polycythemic, and is at risk of congestive cardiac failure. In contrast, the donor fetus becomes anemic, hypovolemic and growth restricted. (Barckley1999).

2-10 Diabetes mellitus:

Is a variable disorder of carbohydrate metabolism caused by a combination of hereditary and environmental factors, insufficient production of or reduced sensitivity to insulin leads to hyperglycemia or it is (an abnormal elevation of blood glucose level) and glucosuria, excess sugar is excreted in the urine. there is increased incidences in obese and lower socio-economic population . (Dean 1992).

Diabetes mellitus make worse by pregnancy and that increases the risk of pregnancy complications . (Dean 1992).

Diabetes mellitus is the most common maternal factor , the exact mechanism for polyhydramnios with diabetes is unclear. It may represent fetal polyuria secondary to fetal hyperglycemia. (Wilkins1987).

- Classification: The main types of diabetes mellitus are:

2-10-1 Insulin deppendant diabetes mellitus (IDDM) (type1):

Is a sudden onset of deficiency of insulin due to a marked decline in the number of insulin-producing beta cells, it most commonly develops in younger than age 20 years. (Dean 1992).

2-10-2 Non insulin dependant diabetes mellitus (NIDDM) (type2) :

Is associated with obesity and most often occurs in people who are over (40 years) of age (more than 90% of all cases of diabetes mellitus) ,(NIDDM) is most more common than (IDDM). (Dean 1992).

2-10-3 Gestational diabetes mellitus(GDM) :

Describes a woman who develops diabetes during pregnancy or is discovered to have diabetes during pregnancy. Most of cases of diabetes in pregnancy represent gestational diabetes mellitus. (Dean 1992).

2-10-3-1Detection:

Is a measure of the level of glycolated hemoglobin (HbA1) , (which is a type of adult hemoglobin to which glucose molecules have attached to open part of the beta chain.

(HbA1) levels are indicators of blood glucose levels through the preceding (1-3) months. (Wilkins1987).

2-10-3-2 Glucose tolerance test :

Most practitioners routinely screen all pregnant women for gestational diabetes. Some encourage testing only for women at higher risk , obese or have a family history of diabetes .(Wilkins1987).

The glucose screen is usually done between (week 24) of pregnancy and (week 28) of pregnancy. It might be done earlier if you had gestational diabetes with a previous pregnancy or if you have multiple tests showing glucose in your urine.(Wilkins1987).

2-10-3-3 Risk factors for the development of gestational diabetes mellitus include:

Strong family history of diabetes, fasting glycosuria , previous unexplained perinatal loss ,previous large for dates infant , previous gestational diabetes , gross maternal obesity . (Dean 1992).

2-10-3-4 Effects of diabetes on pregnancy:

Diabetes may adversely affect and have consequences to both the mother and the fetus therefore optimal care and management benefits both.(Dean 1992).

2-10-3-5 Maternal risks:

Cesarean section delivery due to fetal macrosomia ,the most common serious problem caused by gestational diabetes is carrying a very large baby, which can complicate vaginal

delivery , preeclampsia and eclampsia in patients with vascular disease , there is an

increased risk of abruptio placenta , infection, such as acute pyelonephritis ,or severe.

more than 50% of women with gestational diabetes mellitus develop type 2 diabetes with in (5-10) years of delivery.(Dean 1992).

2-10-3-6 Fetal risks:

Intrauterine demise, especially when the diabetes is not managed appropriately, perinatal morbidity from birth injury, shoulder dystocia by traumatic birth injury occur with vaginal delivery of diabetic women, due to macrosomia , low blood sugar, and jaundice, IUGR, with vascular disease, polyhydramnios, which increases risk of preterm delivery, Fetal congenital anomalies: a range of congenital anomalies in multiple organ systems are increased in poorly controlled diabetes during organogenesis , macrosomia .(Dean 1992).

2-10-3-7 Macrosomia:

This is the most common complication of gestational diabetes mellitus for the fetus. Statistics show that the highest fetal mortality occurs in the last (2 weeks) of pregnancy in the gestational diabetes mellitus mother. Ultrasound studies have determined that a fairly reliable prediction of macrosomia can be made at (28-29 weeks) of gestation (77% accurate) if the gestational diabetes mellitus is controlled and the mother is delivered at (38) weeks , macrosomia decreases and fetal mortality drops from (6.4% to 3.8 %). (Dean 1992).

Macrosomia defined as a difference of greater than (1.4 cm) in the chest and biparietal diameters (present-day hospital protocols define macrosomia in a new born as one who weighs > 8.8 lbs within 1 hour of birth).(Dean 1992).

Macrosomic infants are usually accompanied by polyhydramnios and organomegaly.
(Dean 1992).

Macrosomia is caused by secretion of insulin and somatomedin, which anabolic reaction , physical exam – macrosomic infant is typically very large with fat , cheeks and large ,all this is response to fetal hyperglycemia.(Dean 1992).

The fetal risks depend on the quality of maternal metabolic control, infants of women with gestational diabetes mellitus have a higher prevalence of overweight or obesity as young children and adolescents, and a higher risk of developing type 2 diabetes later in life. (Dean 1992).

When diabetic women receive optimal care prior to and during gestation ,the perinatal mortality rate is nearly equivalent to that observed in normal pregnancies, the higher incidence of major congenital anomalies in children of women with pregestational or gestational diabetes has been related to poor control of diabetes during organogenesis at 10th menstrual week. (Dean 1992).

Gestational diabetes is treated by controlling blood sugar, some women can do this with a special diet for diabetes and staying active, other women will need insulin shots or diabetes

pills. (Dean 1992).

2-10-3-8 Advantages of ultrasound in diabetic pregnancy :



Figure(2-10) Ultrasound machine

Shows a sonoscape machine used for obstetric– gynecological ultrasound

(Henry 2012).

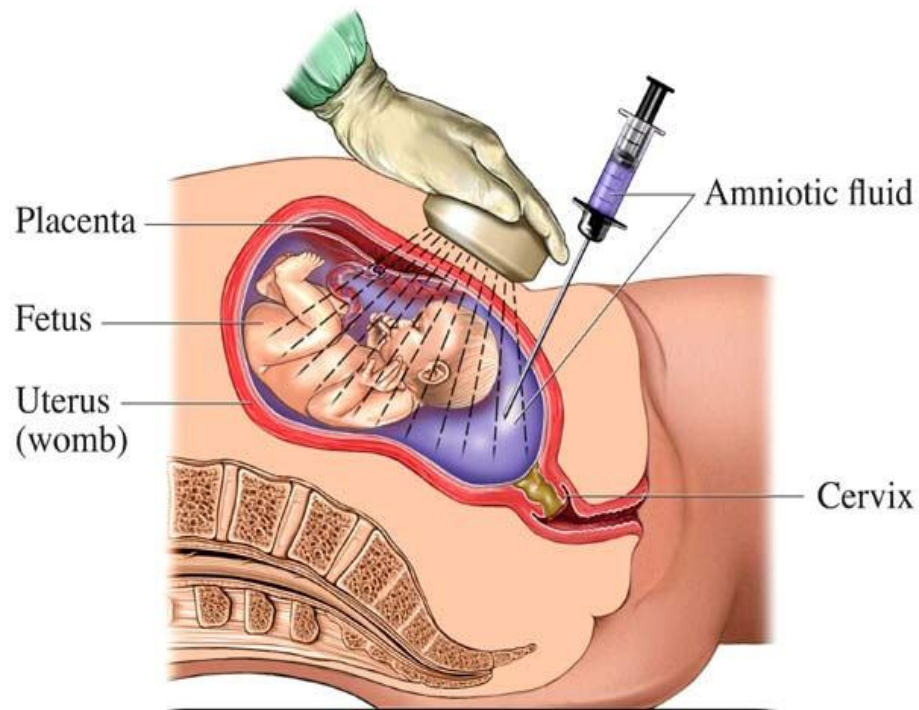
An advanced imaging technologies can improve contrast and temporal resolution, reduce noise, artifacts (side lobes, reverberations) .Ultrasound is an available tool in the management of pregnancies complicated by diabetes and it is an excellent, noninvasive imaging modality, frequently used in detecting:

1. accurate determination of gestational age.
2. diagnosis of abruption placenta .
3. diagnosis of polyhydramnios.
4. major congenital anomalies.
5. non-immune fetal hydrops (edema, ascites, placenta thickening, placentomegally).
6. umbilical cord anomaly. (Dean 1992).
7. Amnioreduction.

2-10-3-9 Amnioreduction:

Is a procedure that can be used to drain excess fluids, is done through amniocentesis, which may carry certain risks to improve pregnancy outcome, there is a chance that fluid could build back up even after draining. For pregnancies complicated by the twin-twin transfusion syndrome, amnioreduction is performed. (<http://dxline/diseases/amniotic fluid>).

In general, painless quick , about (30 seconds) to one minute. to monitor the position of the baby and to make sure that the needle doesn't touch the baby figure (2-11) below . (Dean 1992).



Figure(2-11)Amniocenteces

Show that amniotic fluid or liquor amnii is the protective liquid contained by the amniotic sac of a pregnant female. (Mamopoulos 1990).

2-11 Previous studies

Previous studies documented the ultrasound image of amniotic fluid volume has contributed greatly to the understanding, identification, diagnosis, treatment and management of numerous conditions.

-To evaluate the amniotic fluid volume in diabetic patient to show the effect of diabetes on pregnancy. Ultrasound was done by using mindray (6600, 2200) with (3.5MH) convex probe. This previous study was conducted on (49 women) with diabetes mellitus from (December 2011 to April 2012). The result show the amniotic fluid index in all patients with diabetes mellitus (26%) of patients had increasing amniotic fluid volume .The largest type of diabetic was type1 (38.8%) ,type2 (36.7%) ,GD (24.5%). (Rian 20013).

-To study the relationship between amniotic fluid glucose concentration and the amniotic fluid index in pregnancies complicated by insulin-treated diabetes and to compare it with that seen in normal pregnancies.

Amniotic fluid index and amniotic fluid glucose levels were measured before elective repeated cesarean delivery in (41 women) with insulin-treated diabetes and in (35 women) without diabetes. were included. Women with diabetes were hospitalized for approximately (4 weeks)before delivery, during which time glycemic control was optimized. Amniotic fluid index and amniotic fluid glucose concentration were correlated with each other and were compared between the groups with and without diabetes.

Result showed the mean amniotic fluid index was significantly increased in the diabetes group (16.6 ± 5.0 cm in the diabetes group vs 13.4 ± 3.5 cm in the control group; $P = .002$). The amniotic fluid glucose concentration was also significantly greater in the diabetes group than in the control group (39 ± 17 mg/dL in the diabetes group vs 24 ± 11

mg/dL in the control group; $P < .001$). Among women with diabetes the amniotic fluid glucose concentration was significantly correlated with the amniotic fluid index ($r = 0.32$; $P = .04$), a correlation not found among the control women. The mean fasting blood glucose concentration among the women with diabetes for the week before amniocentesis was (82 ± 11 mg/dL).

This finding raises the possibility that the hydrops associated with diabetes is a result of increased amniotic fluid glucose concentration. (Wolf 1989)

-Seventy-two patients with gestational diabetes were randomly treated with insulin (20 units NPH and 10 units regular) and diabetic diet, diet alone, or neither. Of the (27 patients) treated with insulin and diet, (2 (7%) had babies weighing more than (8 1/2) pounds. Of the (11 patients) treated with diet alone, (4) (36.4%) had babies weighing more than (8 1/2) pounds Of the (34 patients) treated with neither diet nor insulin, (17 (50%) had babies weighing more than (8 1/2 pounds).

These data support the hypothesis that treatment of the gestational diabetic with insulin will reduce the incidence of fetal macrosomia. (Doland1978).

-(228) women with gestational diabetes between (28 and 32) gestational weeks, (195) had a normal amniotic fluid insulin level (4.8 ± 3.6 microU/ml) while (33) (14.5%) had an elevated level (23.1 ± 10 microU/ml). Women with a normal amniotic fluid insulin level were treated by diet alone. Fourteen of the women with an elevated level were treated by diet alone; (19) received insulin treatment additionally. The fetal outcome of patients with a normal amniotic fluid insulin level and dietary therapy and of those with an elevated level and insulin treatment was similar to that of metabolically healthy women. The newborns of gestational diabetics with elevated amniotic fluid insulin treated by diet alone showed a significantly higher incidence of neonatal hyperinsulinism, hypoglycemia, hyperbilirubinemia, high birth weight, respiratory

distress syndrome and hypocalcemia, while (2/14) (14%) of the neonates in the dietary group had fatal respiratory distress syndrome, there were no deaths in the group with elevated amniotic fluid insulin and insulin treatment.

The data demonstrate that in gestational diabetics with normal amniotic fluid insulin (low-risk group), dietary therapy is sufficient while insulin therapy is required to ensure healthy offspring in patients with elevated amniotic insulin (high-risk group). (Fetal outcome in gestational diabetes with elevated amniotic fluid insulin levels. (Hofmann 1988).

Chapter three

Methodology

Chapter three

Methodology

Material and methods

3-1 Material:

3-1-1 Patient:

A fifty diabetic pregnant women were referred to the ultrasound department for check up to assess the amount of amniotic fluid at Elskaikh Fadul and Elsoudy hospital.

Inclusion criteria: All diabetic pregnant women .

Exclusion criteria: Normal (non diabetic) pregnant women.

3-1-2 Equipment:

In this study, transabdominal scanning was done by using (sonoescape) device ,with (3.5 MH) , convex probe , and measured amniotic fluid volume by single deepest pocket and amniotic fluid index (4 pockets) in the second and third trimesters of pregnancy .



Figure(3-1) Ultrasound machine

(Henry 2012).

3-2 Method of study:

Each patient scanned twice in an international scanning guidelines, first by the researcher and then by a qualified sonologist to confirm the findings and diagnosis.

3-2-1 Technique:

An ultrasound procedure used to assess the amount of amniotic fluid. Patient positioning was supine, applied coupling gel to lower abdomen, the deepest vertical pocket measured by using (3.5 MH) and (5MH) frequencies.

The amniotic fluid index measured by dividing the uterus into four imaginary quadrants. The linea nigra used to divide the uterus into right and left halves. The umbilicus served as the dividing point for the upper and lower halves.

The transducer kept parallel to the patient's longitudinal axis and perpendicular to the floor. The deepest, unobstructed, vertical pocket of fluid measured in each quadrant in centimeters. The four pocket measurements done then added to calculate the amniotic fluid index. Normal amniotic fluid index values range from (5 to 25 cm).



Figure (3-2) Ultrasound technique of Amniotic fluid index

Shows the convex transducer in longitudinal axis and patient supine to measure the amniotic fluid index. (Henry 2012).

3-2-2 Data analysis method:

It carried out by computer programming (SPSS), data collecting sheet (questionnaire) and correlation .

Study variables:

Maternal ages , parity , diabetes mellitus type , diabetes mellitus status , trimester , occupation.

Chapter four

Results

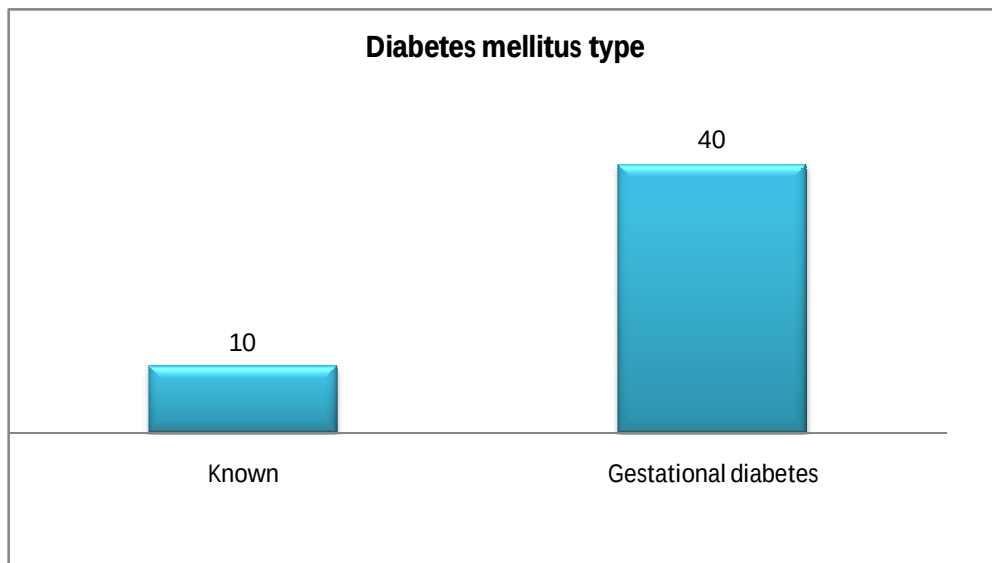
Chapter four

Results

This study was done to assess amniotic fluid volume in diabetic pregnant women using ultrasound as diagnostic tool. The following tables and graphs shows the result .

Table(4-1) Study group percentage of diabetes mellitus type

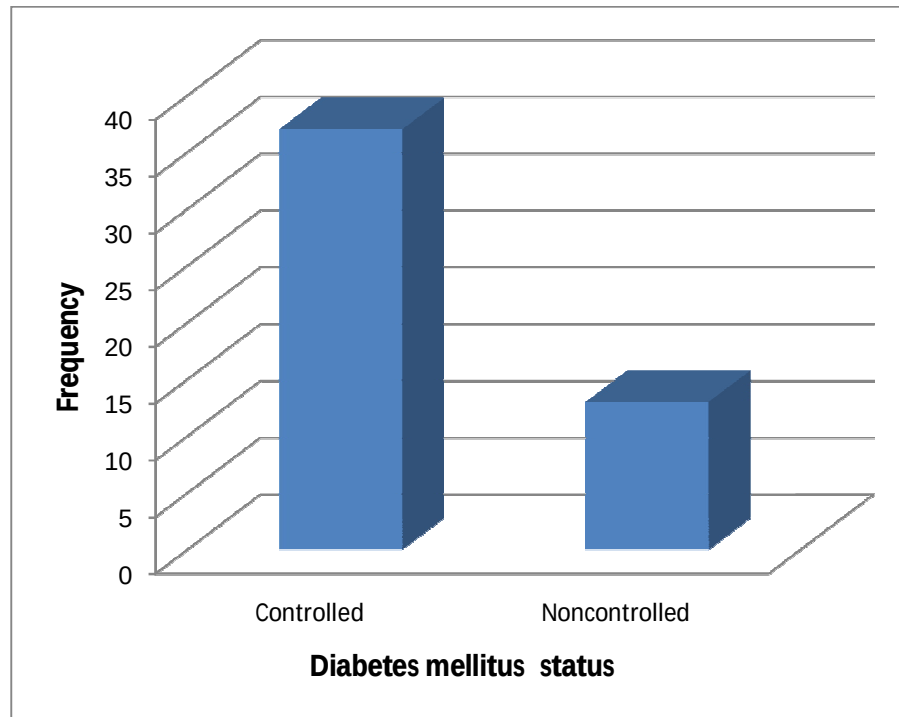
Diabetes mellitus type	Frequency	Percent
Gestational diabetes	40	80.0
Known diabetes	10	20.0
Total	50	100.0



Figure(4-1) Showed frequency and percentage of diabetes mellitus type

Table(4-2) Frequency and percentage of diabetes mellitus status

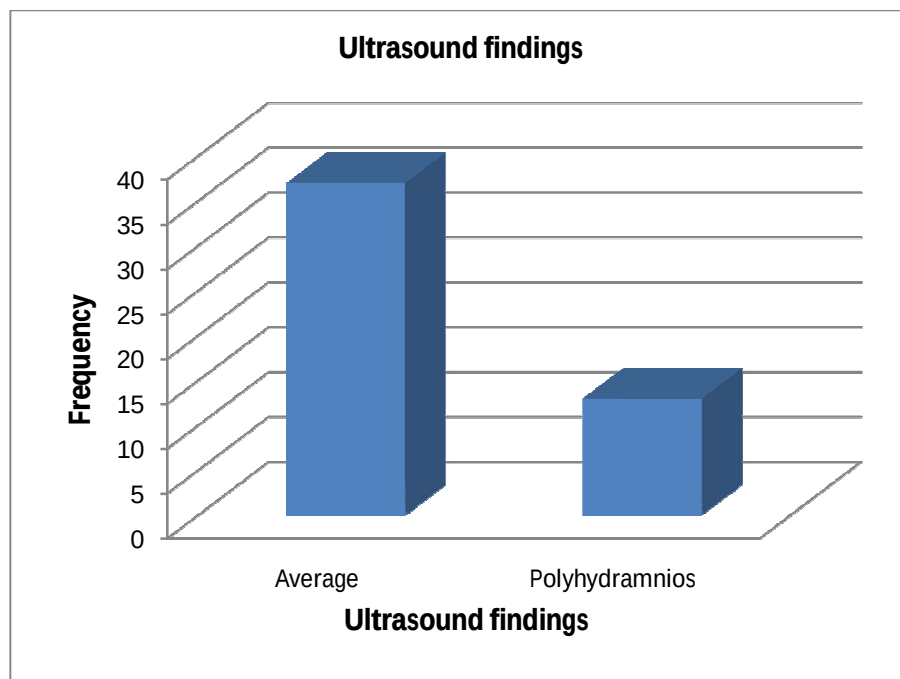
Diabetes mellitus status	Frequency	Percent
Controlled	37	74.0
Noncontrolled	13	26.0
Total	50	100.0



Figure(4-2) Showed frequency and percentage of diabetes mellitus status

Table(4-3) Frequency and percentage of ultrasound findings

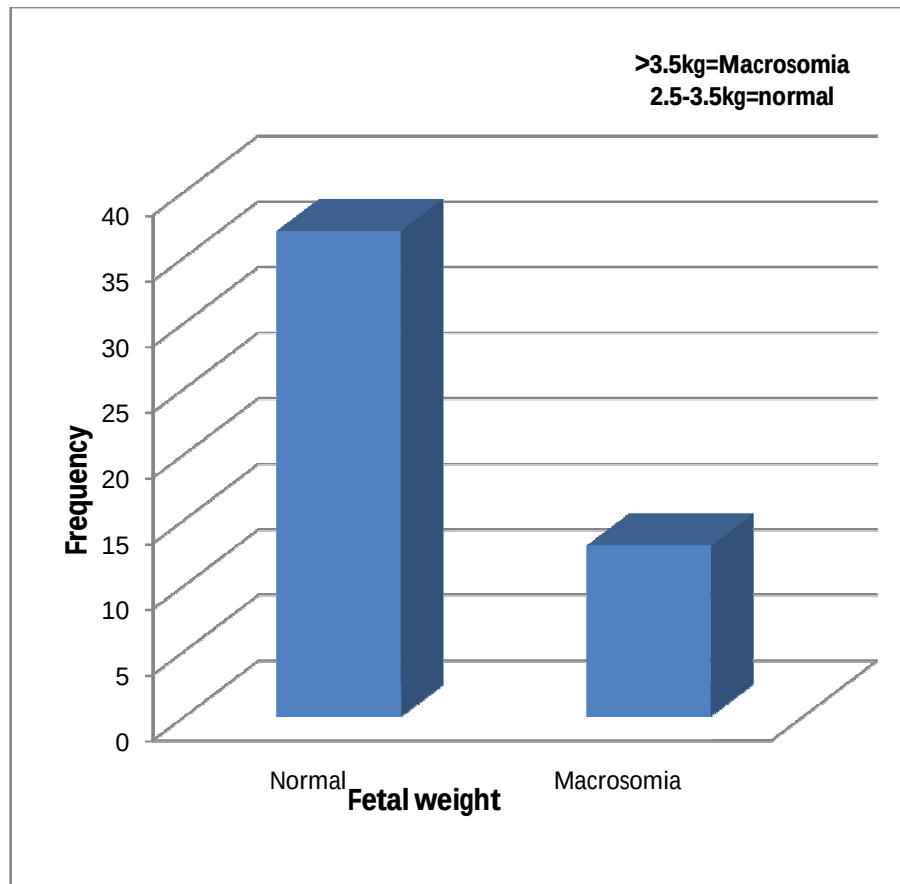
Ultrasound findings	Frequency	Percent
Average	37	74.0
Polyhydramnios	13	26.0
Total	50	100.0



Figure(4-3) Showed frequency and percentage of ultrasound findings

Table(4-4) Frequency and percentage of fetal weight

Fetal weight	Frequency	Percent
Normal	37	74.0
Macrosomia	13	26.0
Total	50	100.0



Figure(4-4) Showed frequency and percentage of fetal weight

Table(4-5) Frequency and percentage of history of polyhydramnios

History of polyhydramnios	Frequency	Percent
Yes	16	32.0
No	34	68.0
Total	50	100.0

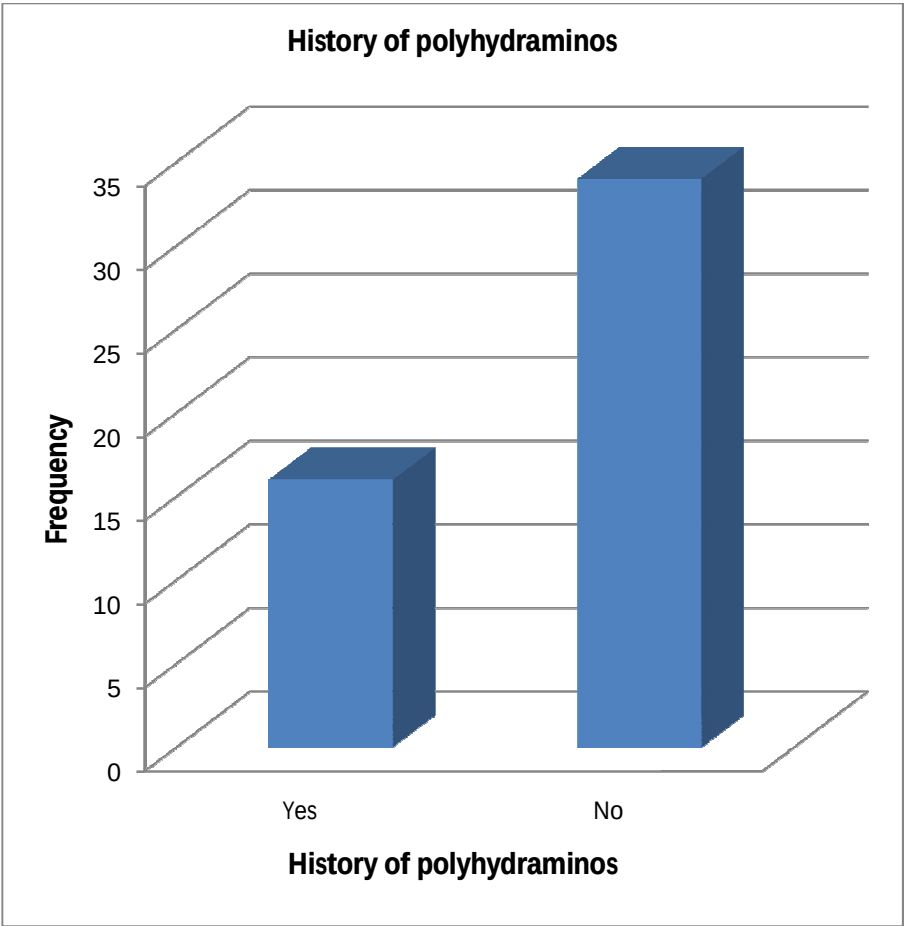
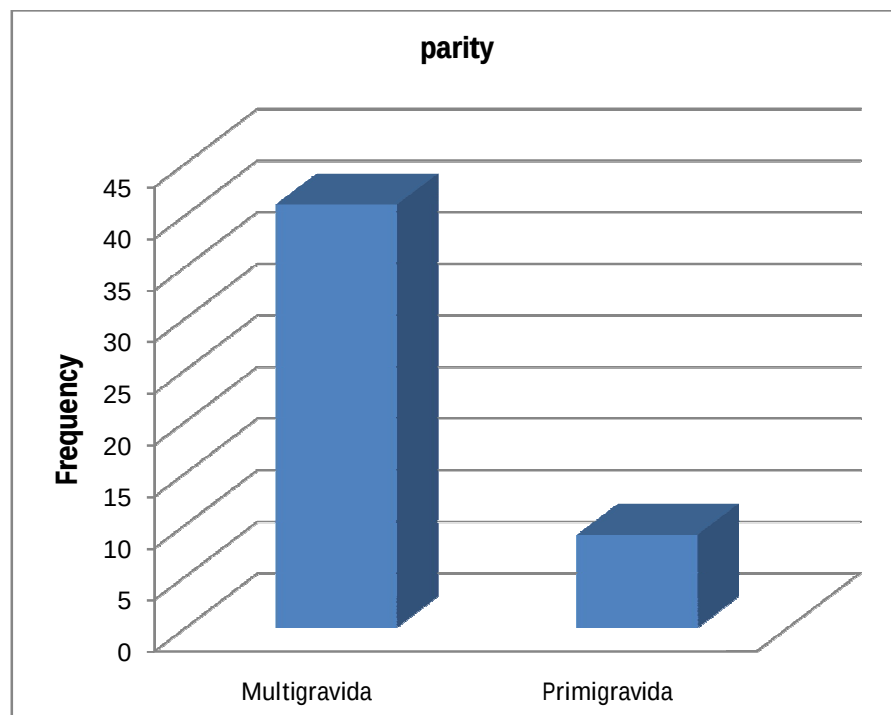


Figure (4-5) Showed frequency and percentage of history of polyhydramnios

Table(4-6) Frequency and percentage of parity

parity	Frequency	Percent
Multigravida	41	82.0
Primigravida	9	18.0
Total	50	100.0



Figure(4-6) Showed frequency and percentage of parity

Table(4-7) Frequency and percentage of trimester

Trimester	Frequency	Percent
Second	5	10.0
Third	45	90.0
Total	50	100.0

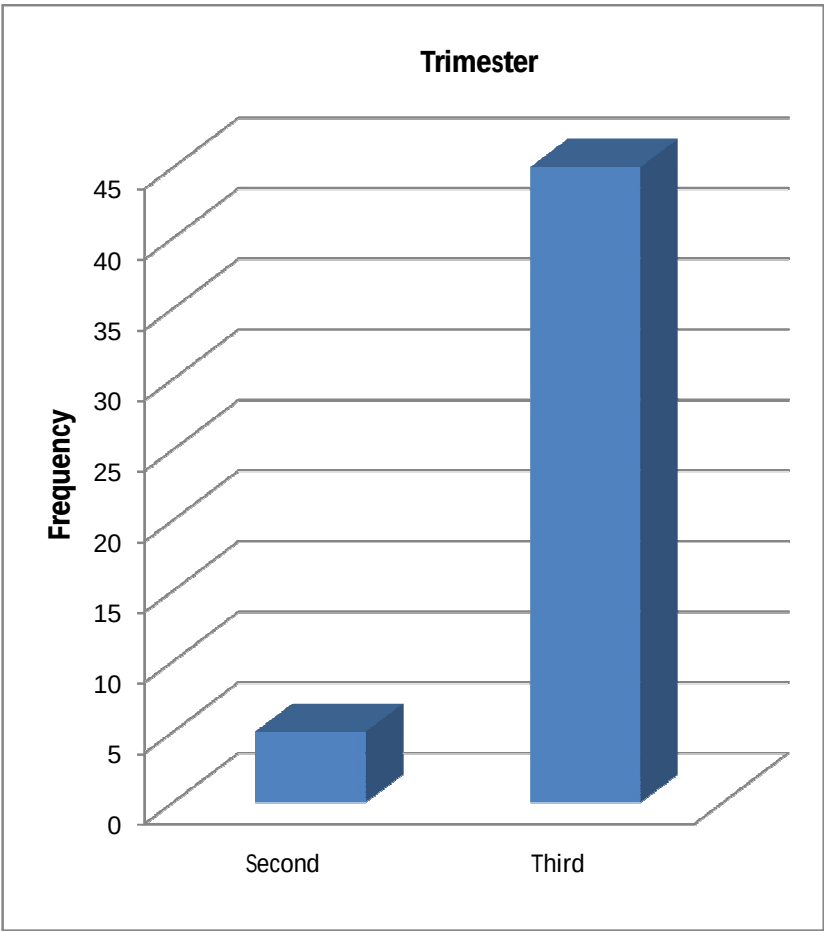


Figure (4-7) Showed frequency and percentage of trimester

Table(4-8) Single vertical pocket versus ultrasound findings crosstabulation

Single vertical pocket	Ultrasound findings		Total
	Average	Polyhydramnios	
(3-8)	37	0	37
> 8	0	13	13
Total	37	13	50

Table(4-9) Amniotic fluid index versus ultrasound findings crosstabulation

Amniotic fluid index	Ultrasound findings		Total
	Average	Polyhydramnios	
5-25	37	0	37
> 25	0	13	13
Total	37	13	50

Table(4-10) Diabetes mellitus type versus ultrasound findings crosstabulation

Diabetes Mellitus Type	Ultrasound findings		Total
	Average	Polyhydramnios	
Gestational diabetes	31	9	40
known diabetes	6	4	10
Total	37	13	50

Table (4-11) Diabetes mellitus status versus ultrasound findings crosstabulation

Diabetes mellitus status	Ultrasound findings		Total
	Average	Polyhydramnios	
Controlled	37	0	37
Noncontrolled	0	13	13
Total	37	13	50

Table (4-12) Diabetes mellitus status versus diabetes mellitus type crosstabulation

Diabetes mellitus status	Diabetes mellitus type		Total
	Gestational diabetes	Known diabetes	
Controlled	31	6	37
Noncontrolled	9	4	13
Total	40	10	50

Table(4-13) Fetal weight versus ultrasound findings crosstabulation

Fetal weight	Ultrasound findings		Total
	Average	Polyhydramnios	
Normal	37	0	37
Macrosomia	0	13	13
Total	37	13	50

**Table(4-14) History of polyhydramnios versus ultrasound findings
crosstabulation**

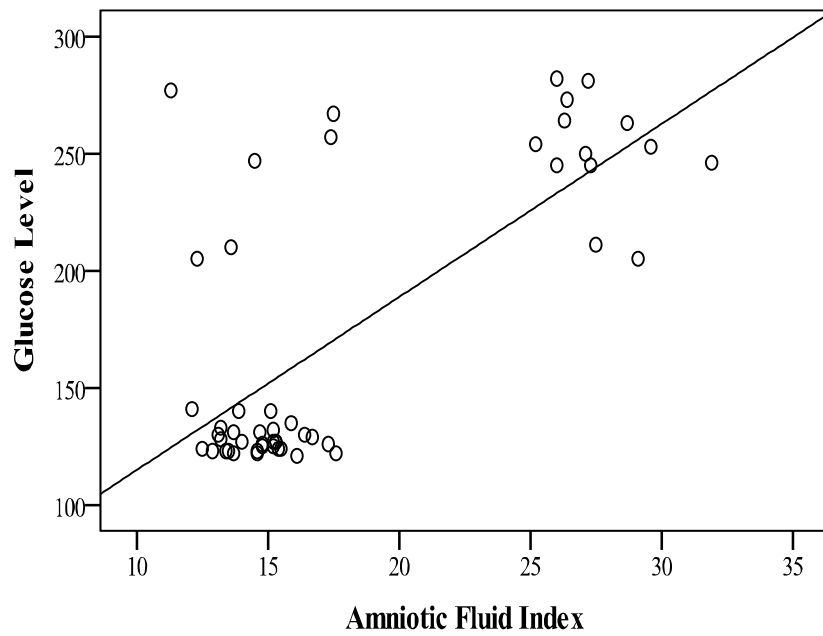
History of polyhydramnios	Ultrasound findings		Total
	Average	Polyhydramnios	
Yes	9	7	16
No	28	6	34
Total	37	13	50

	Mean	Std. Deviation
	18.00	5.955
	5.77	2.824
	34.82	3.936
	32.94	7.127

Table(4-16) Correlations

Correlations		Glucose level	Amniotic fluid index
Glucose level	Pearson correlation	1	.714**
	Sig. (2-tailed)		.000
	N	50	50

**** Correlation is significant at the 0.01 level (2-tailed).**



Table(4-17) Correlations

Correlations		Glucose Level	Single Vertical Pocket
Glucose level	Pearson correlation	1	.675**
	Sig. (2-tailed)		.000
	N	50	50
Single vertical pocket	Pearson correlation	.675**	1
	Sig. (2-tailed)	.000	
	N	50	50

Table(4-17) Correlations

Correlations		Glucose Level	Single Vertical Pocket
Glucose level	Pearson correlation	1	.675**
	Sig. (2-tailed)		.000
	N	50	50
Single vertical pocket	Pearson correlation	.675**	1
	Sig. (2-tailed)	.000	
	N	50	50

** Correlation is significant at the 0.01 level (2-tailed).

Chapter five

Discussion

Conclusion

Recommendations

Chapter five

Discussion

This study for assessment of amniotic fluid volume in fifty diabetic pregnant women during the second and third trimesters of pregnancy.

This study showed that according to the type of diabetes there were (40 pregnant women) which was (80%) were gestational diabetes and the remaining (10 pregnant women) which was (20%) were known diabetic, all of which had great effect on the increasing volume of amniotic fluid. From table (4-2).This result was the same with the study of (Rian 20013).

This research found that the controlled diabetic were(37 of pregnant women) which was(74%)and the noncontrolled were (13 of pregnant women) which was (26%). From table (4-3) , that mean from table (4-2) and table (4-3) , the type of diabetes and diabetic status had a strong effect on amniotic fluid volume and this result matching with the study of (Rian 20013).

This study found in assessing of fetal weight showed that(37 fetuses) which was (74%) were with in normal weight and (13fetuses) which was (26%) are bigger than (3.5 Kg) (macrosomia). From tabe (4-5) , that mean the diabetes affect the weight of the fetus. This matching with the study of (Donald 1978).

This study found according to the history of polyhydramnios there were (16 pregnant women) which was (32%) had ahistory of polyhydramnios and (34) of them which was (68%) had no history of polyhydramnios From tabe (4-6) , and this result matching with the study of (Rian 20013) .

This study showed that the multigravida were (41 pregnant women) which was (82%) and primigravida were (9 pregnant women) which was (18%) From table(4-7) , this was the same with the study of (Rian 20013).

This study found that there was (45) of the pregnant women were on the third trimester which was (90%) affected with diabetes mellitus while only (5 pregnant women) on the second trimester which was (10%) affected with diabetes mellitus. From Table (4-8), this was the same with the study of (Rian 20013).

Macrosomia of the fetus, multigravida pregnant women and third trimester had increased amniotic fluid volume, that mean the diabetes affected the weight of the fetus , parity and trimester of pregnancy.

This research found that, the single vertical pocket (3-8) cm , with in normal in (37 pregnant women) ,which was (74%). there were (13 pregnant women) which was (26%) had polyhydramnios (>8 cm) increased amniotic fluid volume , from table (4-10).This was the same with the study of (Rian 20013).

This study showed that the amniotic fluid index in (5- 25cm),with in normal in (37 pregnant women) which was (74%) when there were (13 pregnant women) which was (26%) had polyhydramnios (>25 cm) increased amniotic fluid volume ,from table (4-11), this was the same with the study of (Rian 20013).

This study showed there were (9 pregnant women) had a history of polyhydramnios and had got an average amniotic fluid volume from (16 pregnant women) when (28pregnant women) had no history of polyhydramnios and had got an average amniotic fluid volume from (34 pregnant women), there were (7 pregnant women) had a history of polyhydramnios and had got an increased amniotic fluid volume from (16 pregnant women) when (6 pregnant women) had no history of polyhydramnios and had got an increased amniotic fluid volume from (34 pregnant women).Table (4-12) , this was the same with the study of (Rian 20013).

This study showed there were (31pregnant women) had controlled diabetes and the type of diabetes was gestational from (40 pregnant women) ,while (6 pregnant women)

had controlled diabetes and the type was known diabetes from (10 pregnant women) , when (9 pregnant women) had noncontrolled diabetes and the type was gestational diabetes from (40 pregnant women) , and (4 pregnant women) had noncontrolled diabetes and the type was known diabetes from (10 pregnant women) .Table (4-14) , this was the same with the study of (Rian 20013) and (Hofmann1988).

The results of this study showed that there was a strong correlation between the amniotic fluid index and glucose level with a correlation co-efficient of ($r = 0.7$) , where the result indicated that the amniotic fluid increased as a result of increasing of glucose level directly .From table (4-19) , this was the same with the study of (Wolf 2000).

Conclusion

Ultrasound can be used to assess the amount of amniotic fluid .

Amount of amniotic fluid can be used as indicator for pregnant women .

Amniotic fluid index between (5-25) cm and single deepest pocket measurement of (2-8) cm, was considered normal in the Sudanese population.

(74%)of the diabetic pregnant women in this study had amniotic fluid volume within the normal limits, the incidence of polyhydromnios in this study was (26%) in the Sudanese population.

This research showed that the amniotic fluid volume increased as a result of increasing of glucose level directly.

This study showed that the measurement of amniotic fluid volume by two methods by ultrasound and compare it with the type and status of diabetes play a great role in explaining the effects of diabetes mellitus on pregnancy.

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Recommendations

- The majority of the diagnostic centers use the objective method which is observer dependent and not reproducible. This may be in part due to the limited resources in Sudan in terms of both equipment and trained personnel.
- Amniotic fluid index is superior to the single deepest pocket and more accurate to assess the amniotic fluid volume and its prediction of prenatal mortality has been confirmed.
- We recommend that amniotic fluid volume should be measured as apart of the routine antenatal care protocols.
- Ultrasound machines should be available at each and every obstetrical clinic or center.
- More training programs should be encouraged so that more trained personnel are available.
- Controlling the weight gain during pregnancy may prevent diabetes.
- It is important to keep being tested for diabetes regularly after pregnancy.
- This study is just a starting point; more work should be done to find the different limits of the amniotic fluid volume in diabetic pregnancy using amniotic fluid index.

Data collection sheet

Ultrasound of amniotic fluid in diabetes mellitus for Sudanese population in the second and third trimesters of pregnancy

1.Serial number

2.Date

3.Age:

a. 15- 19 ()

b.20- 24 ()

c. 25-29 ()

d. 30-34 ()

e. 35-39 ()

f. 40-44 ()

4.Occupation:

1- House-wife ()

2-Employee ()

3-Student()

5.Province:

6.Medical history:

1 -Diabetes ()

2 –Previous polyhydramnios ()

7.Standard of living:

1- High ()

2-Middle ()

3-Low ()

8.Parity :

1-Multigravida ()

2- Primigravida ()

9.Diabetes mellitus:

1-GD ()

2-Known diabetic ()

10.LMP

11.GA

12.EDD

13.No-of fetuses

1-Single ()

2- Twins ()

3-Three or more ()

14. Fetal weight:

1- Normal (2.5-3.5kg)

2-Macrosomia (>3.5)

15.Amniotic fluid volume:

1-Normal ()

2-Increased ()

16.Measurement of amniotic fluid volume :

1- AFI () cm

2-MVP () cm

17. Cause of polyhydramnios:

1-Diabetes mellitus ()

2-Idiopathic ()

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Appendixes



Image 1:

This image for longitudinal scanning of non-controlled diabetic women with age of (43years) , gestational age (38weeks) and polyhydramnios single deepest pocket of amniotic fluid measure (17cm).(Sonoscape machine).



Image 2 :

This image for longitudinal scanning of controlled diabetic women with age (36 years), gestational age (29 weeks) and normal single deepest pocket of amniotic fluid measure (4.5cm).(Sonoscape machine).



Image 3 :

This image for longitudinal scanning of controlled diabetic women with age (40years), gestational age (38weeks) and normal single deepest pocket of amniotic fluid measure (4.7cm).(Sonoscape machine).



Image 4 :

This image for longitudinal scanning controlled diabetic women with age (43 years), gestational age (22 weeks) and normal single deepest pocket of amniotic fluid measure (6.3cm).(Sonoscape machine).



Image 5 :

This image for longitudinal scanning of controlled diabetic women with age (39 years), gestational age (35 weeks) and normal single deepest pocket of amniotic fluid measure (5cm).(Sonoscape machine).



Image 6 :

This image for longitudinal scanning of controlled diabetic women with age (38 years), gestational age (35 weeks) and normal single deepest pocket of amniotic fluid measure (3.7cm).(Sonoscape machine).



Image 11 :

This image for longitudinal scanning of controlled diabetic women with age (39years), gestational age (27 weeks) and normal single deepest pocket of amniotic fluid measure (6.4 cm).(Sonoscape machine).



Image 12 :

This image for longitudinal scanning of controlled diabetic women with age (38 years), gestational age (26 weeks) and normal single deepest pocket of amniotic fluid measure (5.7cm).(Sonoscape machine).



Image 15 :

This image for longitudinal scanning of controlled diabetic women with age (39 years), gestational age (33 weeks)and normal single deepest pocket of amniotic fluid measure (5.2 cm).(Sonoscape machine).



Image 16 :

This image for longitudinal scanning of controlled diabetic women with age (41 years), gestational age (38 weeks) and normal single deepest pocket of amniotic fluid measure (4.0 cm).(Sonoscape machine).



Image 17 :

This image for longitudinal scanning of controlled diabetic women with age (37 years), gestational age (23 weeks) and normal single deepest pocket of amniotic fluid measure (3.9cm).(Sonoscape machine).



Image 18 :

This image for longitudinal scanning of controlled diabetic women with age (39 years) and gestational age(35 weeks) and normal single deepest pocket of amniotic fluid measure (5.5cm).(Sonoscape machine).



Image 19 :

This image for longitudinal scanning of controlled diabetic women with age (40 years) and gestational age (26weeks) and normal single deepest pocket of amniotic fluid measure (7.1cm).(Sonoscape machine).



Image 20 :

This image for longitudinal scanning of controlled diabetic women with age (41 years) and gestational age (26 weeks) and normal single deepest pocket of amniotic fluid measure (5.9cm).(Sonoscape machine).





Image23

This image for longitudinal scanning of controlled diabetic women with age of (39 years) and gestational age (33weeks) and normal single deepest pocket of amniotic fluid measure (4.4cm) .(Sonoscape machine).



Image24

This image for longitudinal scanning of controlled diabetic women with age of (37 years) and gestational age (36 weeks) and normal single deepest pocket of amniotic fluid measure (4.8cm) .(Sonoscape machine).



Image25

This image for longitudinal scanning of controlled diabetic women with age of (42yaers) and gestational age (35 weeks)and normal single deepest pocket of amniotic fluid measure (5.4cm). (Sonoscape machine).



Image26

This image for longitudinal scanning of controlled diabetic women with age of(37 years) and gestational age (35 weeks) and normal single deepest pocket of amniotic fluid measure (5.8cm) .(Sonoscape machine).



Image27

This image for longitudinal scanning of controlled diabetic women with age of (38 years) and gestational age (37 weeks) and normal single deepest pocket of amniotic fluid measure (4.9cm).(Sonoscape machine).



Image28

This image for longitudinal scanning of controlled diabetic women with age of (31 years) and gestational age (34 weeks) and normal single deepest pocket of amniotic fluid measure (5cm).(Sonoscape machine).



Image29

This image for longitudinal scanning of controlled diabetic women with age of (38yaers) and gestational age (36 weeks) and normal single deepest pocket of amniotic fluid measure (4cm). (Sonoscape machine).



Image30

This image for longitudinal scanning of controlled diabetic women with age of (38yaers) and gestational age (35 weeks) and normal single deepest pocket of amniotic fluid measure (3.5cm) .(Sonoscape machine).