



Sudan University of Science and Technology

College of Graduate Studies

Assessment of Amniotic Fluid Volume in Second and Third Trimester by Ultrasound in Pregnant Women

تقييم حجم السائل الأمنيوسي في الفترة الثانية والثالثة من الحمل باستخدام الموجات فوق الصوتية

A Thesis Submitted for partial fulfillment for the degree of master (M.Sc.) in
Medical Diagnostic Ultrasound

Presented by:

Hala ElAwni Mahdi ElAwni

Supervisor by:

Dr. Babiker Abd El Wahab Awad Allah

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

الآية

قال الله تعالى:

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(أَوْلَمْ يَرَ الَّذِينَ كَفَرُوا أَنَّ السَّمَاوَاتِ وَالْأَرْضَ كَانَتَا رَتْقًا فَفَتَقْنَاهُمَا وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ أَفَلَا يُؤْمِنُونَ))

صدق الله العظيم

سورة الانبياء، الآية (30)

Dedication

To my husband for continuous support and advice

To my Parents who have always been there for me in my highest and lowest

To my Brothers who have always shown me support in and stood by me in all
times.

My colleagues who always guide me to success and gave me advises and help
to excel above others.

And to Every person who shared their knowledge and Ideas with me.

Wishing you all the best in life.

Thank You...

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My thank must go to the ultrasound department of Kosti Teaching Hospital, thank them for their good support during collection of data

I gratefully would like to pass my special thank to my friends and colleagues who help me.

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Abstract

The study was carried out to assess the amniotic fluid volume in pregnant women in second and third trimester, so as to decrease the risk that lead to fetal morbidity and mortality and to optimize safe mother hood through using ultrasound. The study aimed to identify normal values of amniotic fluid index in pregnant women in second and third trimester, to a detect causes of polyhydramnios and oligohydramnios and to correlate gestation age with normal amniotic fluid volume

The study was conducted on 90 pregnant women their second and third trimester over a period from August 2015 to December 2015, in Kosti Teaching Hospital, depended on the international study protocol in obstetrical scanning. All pregnant women were subjected to be examined by U/S scanning using Toshiba and General Electric scanner with 3.5MHz convex probe.

Trans abdominal scanning were performed for all pregnant women and measure the amniotic fluid volume by using, the four –quadrants amniotic fluid index (AFI) and the deepest pocket (large pocket) methods.

The problem of study is that the difficult measurement of oligohydramnios by ultrasound.

The study found that most of the pregnant women have normal amniotic fluid (88.9%) and few others pregnant women have an abnormal amniotic fluid (11.1%). The study showed the normal range of amniotic fluid index in pregnant women from 24-40 weeks, it showed that the mean of normal amniotic fluid index reach its peak at 26 week gestation and gradually declined at 40 week gestation .

The study recommended that assessment of amniotic fluid volume by ultrasound is an essential parameter of the antenatal care. For better interpretation of amniotic fluid index normal reference values in varies weeks of pregnancy in pregnant women in Sudan is recommended. The study also recommended facilitating ultrasound machine in every hospital and medical health centers.

ملخص الدراسة

أجريت هذه الدراسة بغرض قياس حجم السائل الأمنيوني حول الجنين للنساء الحوامل في الفترة الثانية والثالثة من الحمل باستخدام الموجات فوق الصوتية , وذلك لتجنب المخاطر التي تؤدي إلي وفيات الأطفال أثناء الولادة والحفاظ علي سلامة النساء والجنين.

هدفت الدراسة لتحديد القيمة العادية لمؤشر السائل الأمنيوني للنساء الحوامل قي الفترة الثانية والثالثة من الحمل ومعرفة الأسباب التي تؤدي إلي التغيرات غير الطبيعية (زيادة أو نقصان) ومقارنة حجم السائل الأمنيوني الطبيعي بعمر الجنين .

شملت هذه الدراسة تسعون امرأة حامل في الفترة الثانية والثالثة من الحمل , و أجريت في مستشفى كوستي التعليمي بين أغسطس وديسمبر ٢٠١٥ م . اعتمدت هذه الدراسة علي النظام العالمي في عمل الموجات الصوتية للنساء الحوامل بكل هولاء النساء الحوامل فحصوا بالموجات فوق الصوتية باستخدام جهاز ي توشيبا و جنرال اليكترىك للكشف بالموجات فوق الصوتية مع محبس (أو مسبار) محدب ٣,٥ميقاهيرتس . أجري المسح عن طريق البطن لكل النساء الحوامل , وتم قياس حجم السائل الأمنيوني باستخدام طريقتين هما قياس أربعة جيوب او أجزاء للسائل الأمنيوني وجمعهم لبعض وقياس أكبر عمق أو جيب .

تمثلت مشكلة الدراسة في صعوبة قياس السائل الأمنيوني حول الجنين بالموجات فوق الصوتية إذا كانت كميته بسيطة .

توصلت الدراسة إلى أن معظم النساء الحوامل لهن كمية سائل طبيعية بنسبة ٨٨,٩% وكمية قليلة من النساء لهن كمية سائل غير طبيعية بنسبة ١١,١% وتم إنشاء جدول يوضح كمية السائل الأمنيوني الطبيعي للنساء الحوامل في من الأسبوع ٢٤ إلى الأسبوع ٤٠ من الحمل. ووجدت الدراسة أن كمية السائل الأمنيوني تصل إلي ذروتها في الأسبوع ٢٦ من الحمل وتقل تدريجياً إلى الأسبوع ٤٠ من الحمل .

أوصت الدراسة بضرورة قياس حجم السائل الأمنيوني حول الجنين بواسطة الموجات فوق الصوتية إثناء فترة الحمل , وبإجراء بحوث متعددة لوضع قيمة طبيعية ومرجعية لكمية السائل الأمنيوني الطبيعي للنساء الحوامل في السودان والى الدقة في قياس السائل الأمنيوني حول الجنين للوصول إلى نتائج مرضية وصحيحة . كما أوصت بتوفير أجهزة التشخيص بالموجات فوق الصوتية في جميع المستشفيات والمراكز الصحية .

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Abbreviation

AFI	Amniotic fluid index
AFV	Amniotic fluid volume
GU	Genito urinary
PROM	Premature rupture of membrane
IUGR	Intra uterine growth retardation
AC	Abdominal circumference
HC	Head circumference
BRA	Bilateral renal agenesis
EVS	Endo vaginal sonography
CD	Color Doppler
UPJ	Utero pelvic junction
MCDK	Multi cystic dysplastic kidney
IPKD	Infantile poly cystic kidney disease
KC	kidney circumference
PUV	Posterior urethral valve
TTT	Twin to Twin transfusion syndrome
Mc	Mono chorionic
A.A	Artery – artery
A.V	Artery vein
V.V	vein – vein
MCDA	Mono chorionic diamniotic
DCDA	Dichorionic diamniotic
DC	Dichorionic
3D	Three dimension
IDDM	Insulin dependent diabetes mellitus
NIDDM	Non-insulin dependent diabetes mellitus
U/S	Ultrasound
IVC	Inferior Vena Cava
TA	Transabdominal

Chapter One

Introduction

Chapter One

1.1 Introduction:

The fluid in the amniotic cavity bathing the fetus is known as amniotic fluid or liquor amni. The amniotic fluid is water like, originates from maternal plasma and pass through the fetal membranes by osmotic and hydrostatic forces .The amniotic fluid is seen after 12 days of conception (Trish Chudleigh, et.al2004).

The amniotic fluid is vital to the well-being of the fetus .It cushions the fetus from injury , helps prevent compression of the umbilical cord ,and allows room for it move and grow. In addition, its bacteriostatic action helps prevent infection of the intra-amniotic environment .The quantity of amniotic fluid at any time in gestation,and is the product of water exchange between the mother, fetus, and placenta ,and is maintained within a relatively narrow range. Disorders of this regulatory process can lead to either polyhydramnios or oligohydramnios, in which too much or too little fluid exists, respectively. These disorders may result from abnormal fetal or maternal conditions and, conversely ,may responsible for alteration fetal well-being as well .with the advent of real –time ultrasonography ,assessment of amniotic fluid has been possible ,resulting in earlier recognition of abnormal condition and possible intervention(Devin, 2005).

Ultrasound is a non-invasive procedure, which makes it ideal for application on a very large scale: in practice, it can be used for routine monitoring of all pregnancies and, not infrequently, for repeat AFV determination in some cases where there is the suspect of amniotic fluid abnormalities. In ultrasound appears anechoic area, surrounding the fetus may be with internal echo(www.google.com).

1.2 Problems of study:

The oligohydramnios can be difficult to confirm due to the questionable accuracy of AF measurement by ultrasound, when pocket of AF containing umbilical cord.

AFI measurements may vary with the amount of pressure applied to the abdomen and with fetal position or movement. Serial measurements taken by ultrasound operator have been shown to differ from the true volume by 1cm.

1.3 Objectives:

1.3.1 General Objectives:

To assess AFV by ultrasound in pregnant women in second and third trimester.

1.3.2 Specific Objectives:

- To identify normal values of amniotic fluid index in pregnant women.
- To detect common causes of polyhydramnios and oligohydramnios in pregnant women.
- To correlate gestation Age with amniotic fluid volume in pregnant women.

1.4 Significant of the study:

Evaluate amount of amniotic fluid so can select the best method to determine normal amount of amniotic fluid volume in pregnant women in their second and third trimester.

1-5 Over view of the study :

This study consists of five chapters :

Chapter one : Include (introduction , problem of study and objectives) .

Chapter two: Literature review (anatomy, physiology and pathology) and previous study.

Chapter three: Material and Methods.

Chapter four: Methodology (Data collection, Analysis and Results).

Chapter five: Discussion, Conclusion and Recommendation.

Chapter Two
Literature Review

Chapter Two

Literature Review

2.1 Anatomy

2.1.1 Embryology of amniotic fluid:

Amniotic sac is the sac in which the fetus develops in amniotes it is taught but thin transparent pair of membranes, which hold developing embryo and fetus until later before birth. The inner membrane, the amnion, contains amniotic fluid and the fetus. The outer membrane, the chorion, contains, the amnion and is part of the placenta, by 12 week of gestation the amnion comes into contact with the inner surface of the chorion (Pamela J, 2008).

At the beginning of the second week, a cavity appears within the inner cell mass and when it enlarges is becomes the amniotic cavity (Pamela J, 2008).

The floor of amniotic cavity is formed by epiblast. Epiblast migrates between the epiblast disc and trophoblast, in this way the epiblastic cells migrate between the embryoblast and trophoblast. The epiblast transforms to ectoderm while the remaining cells which are present between embryoblast and trophoblast are called amnioblasts (flattened cell), these cells are also derived from epiblast which is transform into ectoderm(El Rakhawy ,2008).

The amniotic cavity is surrounded by a membrane, called amnion. As the implantation of the blastocyst progress, a small space appears in the embryoblast, which is primordium of amniotic cavity. Soon amniogenic (amnion forming cells) amnioblasts separate from the epiblast and line the amnion, which encloses the amniotic cavity (El Rakhawy, 2008).

Amniotic fluid in the amniotic cavity completely surround the embryo after the 4th week of pregnancy, this firstly water like fluid originate from fetal plasma and passes through membrane by osmotic and hydrostatic forces. (Mowa Dinaael Fe, 2004).

2.1.2 Important of amniotic fluid:

Amniotic fluid is vital to the well-being of the fetus, it cushions the fetus from injury, helps prevent compression of the umbilical cord, and allows room for it to move and grow.

In addition, its bacteriostatic action helps prevent infection of the intra-amniotic environment. The quantity of amniotic fluid at any time in gestation is the product of water exchange between the mother, fetus and placenta, and is maintained within a relatively narrow range. Disorders of this regulatory process can lead to either polyhydramnios or oligohydramnios, in which too much or too little fluid exists, respectively. These disorders may result from abnormal fetal or maternal conditions and, conversely, may be responsible for alterations of fetal well-being as well, with the advent of real-time ultrasonography, assessment of amniotic fluid has been possible, resulting in earlier recognition of abnormal conditions and possible

intervention. Because precise quantification of amniotic fluid volume is not possible with ultrasonography, various techniques for both qualitative and semiquantitative assessment have been proposed (Chamberlain PF, et al 2003).

2.2 Physiology of amniotic fluid:

2.2.1 Amniotic fluid production:

In the first half of pregnancy, amniotic fluid is derived from fetal and possibly maternal compartments. Water and solutes freely traverse fetal skin and may diffuse through the amnion and chorion as well. Thus amniotic fluid in early gestation is a dialysate that is identical to the fetal and maternal plasma, but with a lower protein concentration. Active secretion of fluid from the amniotic epithelium had been previously suggested to play a role in early amniotic fluid formation, but this has not been demonstrated (Richard, et al, 2008).

By the second trimester, the fetal skin becomes keratinized, making it impermeable to further diffusion. At this time, a fetus contributes to amniotic fluid volume and composition almost exclusively through urination. Urine has been observed in the fetal bladder as early as 11 weeks transabdominally. And 9 weeks trans vaginally. By term, a fetus produces on average from 500 to 700 ml/day with a slight decline in hourly fetal urine production after 40 weeks gestation (Peter, 2007).

2.2.2 Amniotic fluid elimination:

Amniotic fluid is eliminated by at least three mechanisms. The primary source of elimination is through fetal swallowing, which has been observed as early as 16 weeks. A fetus swallows from 200 to 450 ml/day at term, removing 50% of the amniotic fluid produced through fetal urination. This fluid is absorbed through the fetal gastrointestinal system and is either recycled through the kidneys or is transferred to the maternal compartment through the placenta (Kumar, et al 2003).

A second, more debatable means of amniotic fluid removal may be the respiratory tract. Fetal respiratory activity has been observed as early as 11 weeks gestation (Kumar, et al 2003).

At term, inspiratory flow in the fetus is approximately 200 ml/kg/ day, up to 600-800 ml/day. Because amniotic fluid is more hypotonic than fetal plasma, it is postulated that exposure of amniotic fluid to the fetal alveolar capillary bed results in net movement of water from the amniotic cavity into the fetus. Although radioisotopes have been discovered in fetal lungs after intra- amniotic instillation, this quantity has been small and inconsistent. Leading investigators to question the actual contribution of fetal respiration to amniotic fluid removal. In fact, surface active phospholipids originating from the fetal alveoli are found in the amniotic cavity, leading to suggestions that the fetal lungs may actually be a net contributor to amniotic fluid volume (Bodely K, et al, 2008)

Amniotic fluid may also potentially be removed by continuous bulk flow (i.e via hydrostatic and oncotic forces). Exchange at fluid may take place at the chorionic plate, where exposure

of the relatively hypotonic amniotic fluid to the fetal surface of the placenta may lead to net reabsorption of water by fetus (up to 80 ml/day).

Transport across the amnion may occur through intercellular channel between amniotic epithelial cells and may be modulated by amniotic fluid prolactin levels. Hebertson and colleagues provided presumptive evidence for the regulatory role of the amniotic epithelium in the transport of fluid. They observed ultra-structural changes in the amnion of pregnancies complicated by disorders of amniotic fluid volume. Whether these changes reflect a causative role in these disorders or rather a response to long – standing fluid imbalance remains to be determined (Cunningham,et al,2005).

A final, perhaps underestimated, pathway for volume regulation may occur within the placenta itself. The large surface area of the fetal capillary/ intervillous interface could magnify small osmolar gradients between a mother and fetus, resulting in large volume of net water transfer.

Exchange of water at this level would influence fetal intravascular volume and potentially affect renal blood flow and urine production.

In addition to bulk flow of fluid, which occurs through pathways that are both phasic (micturition and swallowing) and nonphasic (mediated by hydro static and oncotic gradients), there is also bidirectional flow of water between the amniotic and maternal compartments.

This process occurs by diffusion, but with net change in fluid volume. At term may leave the amniotic cavity at rate of 400 -500 ml/ hour by diffusion plus flow (Kumars,et al 2003).

2.2.3 Normal amniotic fluid volume:

Amniotic fluid volume is most predictable in the first half of pregnancy, when it correlates with fetal weight. This may relate to the predominant contribution of fetal skin dialysis to amniotic fluid volume between 8 and 20 weeks.

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 on, there is greater variance of amniotic fluid volume increases steadily throughout pregnancy to maximum of 400 – 1200 ml at 34 -38 weeks; however, wide variation does exist.

Despite large fluxes of fluid between the various compartments near term (500–700 ml/day through urine; 200–450 ml/day through deglutition), the net 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.16 in some instances, and this reduction may possibly reflect a shift of cardiac output away from the kidneys as a result of a relative uteroplacental insufficiency. Figure 2 – 1 provides approximate volumes at various gestational Ages, based on a compilation of 12 published studies of amniotic fluid volume (Carol M.Rumack,et al 2005).

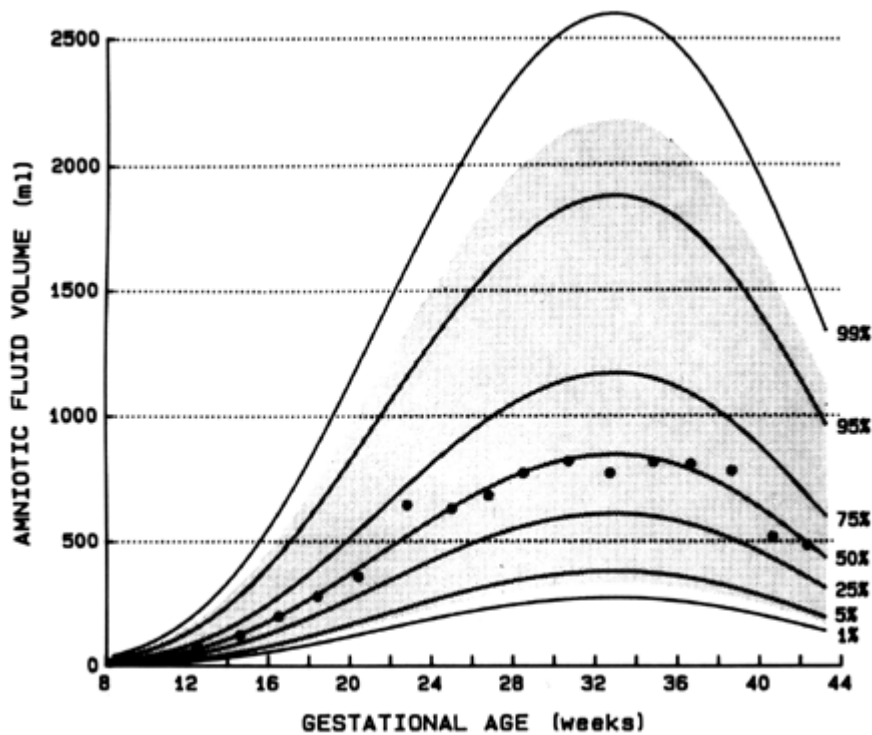


Fig. (2.1). Amniotic fluid volumes as a function of gestational age. Shaded area covers 95% confidence interval. (Brace RA, Wolf EJ: Normal amniotic fluid volume changes throughout pregnancy. Am J Obstet Gynecol 161:382, 2002)

2.2.4 Amniotic fluid function:

Allow room for fetal growth, movement and development, ingestion in to GIT → growth and maturation, fetal pulmonary development (20 weeks), protects the fetus from trauma, maintains temperature, contains anti-bacterial activity prevent intra amniotic environment from infection and aid dilatation of cervix during labour (Cunningham, 2005).

2.3: Methods and technique for assessment of AFV by U/S:

The U/S image had been obtained by using convex probe with high frequency (3-5 MHZ) and gel with patient in supine position. Each patient had been scanned twice, in an international scan guideline and protocols .Firstly by researcher then by a qualified sonologist to confirm the finding and diagnosis.

2.3.1: SUBJECTIVE ASSESSMENT:

-The fetus occupies less than half of the intrauterine volume until approximately 22 weeks in the pregnancy .There after the fetus progressively occupies a larger portion of intra uterine volume.

- This is a qualitative assessment of AFV and is therefore not standardized. (Devin; 2005).

2.3.2: QUANTITATIVE ASSESSMENT:

2.3.2.1: Single Deepest Pocket Measurement:



Figure (2.2) measure the dimension of the largest vertical pocket of AF (Devin; 2005).

< 1cm = oligohydramnios.

1-2cm = decreased fluid.

2-8 cm = normal

> 8 = ployhydramnios (Chamberlain, et.al.2003)

Many authors question the 1cm rule as being too restrictive.

Controversies in cut- off criteria for oligoydramnios (Sherer .2001):

a-< 0.5 mm (Mercer.1984)

- a. < 1 cm (Chamberlain .2003)
- b. < 2cm (Manning .1990)
- c. < 3 cm (Halperin.1985)

2.3.2.2. Amniotic fluid index

Technique:

- a. Divided the uterus in to four quadrants using the lineanigra as the vertical axis the umbilicus as the horizontal axis
- b. The pocket with largest vertical dimension is measured in each quadrant.
- c. Sum of all four measurements = AFI



Figure: (3.3): four pocket Measurement of AFI.Trish, et.al.2004

Values

< 5 cm =very low (oligohydramnios)

5.1 – 8cm = low

8.1 – 2.5 cm = normal.

> 25 cm = polyhdramnios.

2.3.3: Controversies in cut off criteria for Oligohydramnios (Trish, et.al2004:

- a. < 5cm (this represents < 1st centile) .
- b. < 5th centile for gestational age (AFI values of 7.1 and 9.7 cm).
- c. < 7 cm .

d. < 8 cm .

e. Others have considered an AFI > 5 and < 10 as borderline .

Advantages:

a. Easy to perform .

b. More subjective approach than A F assessment.

c. Requires little training to perform and is ideally suited to real time ultrasound.

d. Provides a frame of reference for the inexperienced sonographer.

e. Gives a better assessment of AFV than dose the single deepest pocket measurement, as the sum of all four quadrants correlate more closely with volume than by using a single measurement.

Disadvantages:

a. Wide intra observer & inter observer error (Rumack, et.al.2005).

AFI < 5cm - interobserver error = 2cm.

AFI > 20 cm - interobserver error = 5cm.

b. Technical Limitation.

.Heavy pressure applied by the sonographer with the transducer on the patients abdomen can decrease the height of a pocket fluid.

Artifact, especially anterior reverberation artifacts may obscure AF situated anteriorly. It may also be difficult to visualize lateral pockets due to the position of the transducers.

c. Overestimation.

In the third trimester the umbilical cord may be extremely lucent and without duplex or color Doppler, cord filled pockets of AF may be included in the measurement.

d. Fetal movement:

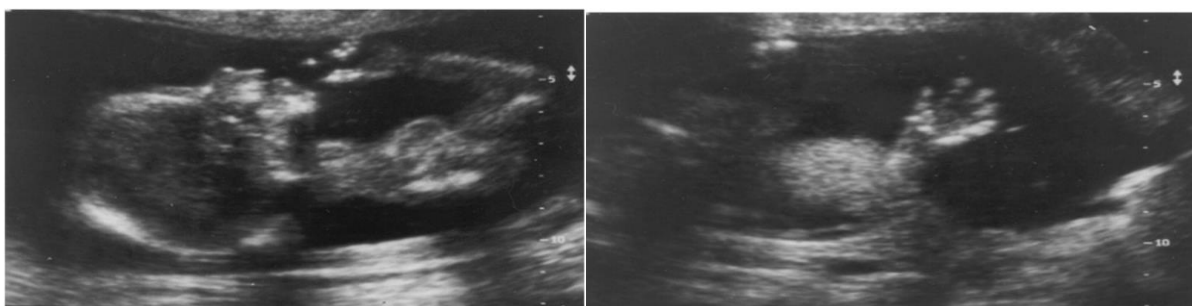


Figure (2.4) Normal AFV with fetal movement.

Rapid movement may be a problem as large pockets may be replaced by multiple small pockets between the extremities.

- d. Pockets with large vertical dimension and small width's will exaggerate the AFI.
- e. Full fetal bladder with oligohydramnios. This fluid should be included in AFI estimation because it will ultimately be excreted and form part of the fluid estimation (Sherer ,2001))



Figure (2.5) Oligohydramnios with full bladder.Sherer et.al.2001

2.3.4 Chamberlain method single vertical pocket measurement:

- < 1 cm is severe oligohydramnios.
- 1- 2 cm is significant oligohydramnios.
- 2- 8 cm is normal.
- 8- 11 cm is mild polyhydramnios.
- 12- 16 cm is moderate polyhydramnios.
- > 16 cm is serve polyhydramnios.

2.3.5 The phelan or four- quadrant amniotic fluid index method:

This method consists of 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 8.0 cm and 24.0 cm considered normal. Refer to the following table for the significance of values less than 8.0 cm and greater than 24.0 cm (Devin, 2005).

The Phelan or four- quadrant amniotic fluid index method:

< 5 cm is severe oligohydramnios.

5.1 - 8 cm is significant oligohydramnios.

8 - 24 cm is normal.

> 24 cm is polyhydramnios.

25- 30 cm is mild polyhydramnios.

30.1- 35 cm is moderate polyhydramnios.

> 35.1 cm is severe polyhydramnios

2.4 Amniotic Fluid Echogenicity:

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 is especially evident at higher transducer frequencies and gain settings. Echogenic amniotic fluid in the first trimester is rare and has been associated as an indirect sign of acrania-anecephaly sequence (A A S) secondary to exfoliation (sloughing) of fetal brain tissue in the amniotic fluid and related bleeding (Trish,et.al2004).

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 vernix caseosa. Vernix caseosa is the normal oily substance produced by fetal skin and covering the fetal skin to protect it in its aqueous environment (Trish,et.al 2004).

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(Devin,2005).

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

2.5 Pathology of amniotic fluid:

2.5.1 Oligohydramnios:

Oligohydramnios is defined as decreased amount of amniotic fluid. Anhydramnios is defined as severe oligohydramnios it may be either acute or chronic, acute is most commonly result of membrane rupture and chronic may result from abnormality of the fetal urinary tract and fetal hypoxia, and is indicated when there is no detectable amniotic fluid pockets on ultrasound examination. There are no associated maternal risk oligohydramnios may be suspected clinically if the measured uterine fundal height is small- for dates with the Chamberlain method oligohydramnios is indicated if the single largest pocket of amniotic fluid measure is less than 2cm with the Phelan method, oligohydramnios is indicated if the sum of the four measured pocked of amniotic is 8 cm or less (Ted Rosenkrantz, 2012).

Visual ultrasound features of oligohydramnios include:

- a) lack of an amniotic fluid space between the anterior uterine wall and the fetal body
- b) relative crowding of fetal parts
- c) Difficulty outlining the umbilical cord (Eberhard Merz, 2003).

2.5.1.1 Most Common Causes of Oligohydramnios

- Premature rupture of membranes
- Chronic fetal death
- postterm pregnancy
- advanced intrauterine growth retardation
- Fetal genitourinary (GU) tract anomalies associated with decreased renal function and diminished urinary output or anomalies compromising the flow of urine into the ureters, bladder, or urethra:
 - a. bilateral renal agenesis (Potter's syndrome)
 - b. bilateral uroteropelvic junction obstruction
 - c. bilateral multicystic dysplastic kidneys
 - d. infantile polycystic kidneys
 - e. posterior urethral valves

f. urethral agenesis -

- Chromosome defects (especially triploidy)
- Twin-to-twin transfusion syndrome (associated with the growth-retarded donor twin).(Devin,2005)

Premature rupture of membrane (PROM):

PROM is defined as rupture of amniochorionic membrane prior to the onset of labor.

Ruptured membranes are signified at any time to during pregnancy by either a sudden gush or a steady trickle of clear fluid from vagina, in term pregnancy, labor usually ensues within 24 hours of membrane rupture.

The main concern is chorioamnionitis may cause fetal death and maternal death, although very uncommon may also occur if a serious maternal septicemia develops (Ted Rosenkrantz 2012).

The causes of PROM have not been clearly identified. Some risk factors include smoking, multiple pregnancies (twins, triplets, etc), and excess amniotic fluid (polyhydromnios). Certain procedures carry an increased risk of PROM, including amniosentesis (a diagnostic test involving extraction and examination of amniotic fluid) and cervical cereluge (a procedure in which the uterus is sewn shut to avoid premature labor). A condition called placenta abruption is also associated with PROM, although is it not known which condition occurs first. In some cases of preterm PROM, it is believed that bacterial infection of the amniotic membrane causes it to weaken and then break. However, most cases of PROM and infection occur in the opposite order, with PROM occurring first followed by an infection.

The main symptom of PROM is fluid leaking from the vagina. It may be sudden, large gush of fluid, or it may be as low, constant trickle of fluid.

The complication that may follow PROM include premature labor and delivery of the fetus, infections of the mother, and/ or of the fetus, and compression of the umbilical card (leading to oxygen deprivation in the fetus).

Treatment of PROM depend on the stage of the patients pregnancy (Ted Rosenkrantz, 2012).

Fetal death:

Second and third trimester fetal demise can be attributed to many different single causes, or to a combination of causes. They are acute etiologies such as abruption or umbilical cord complication; sub-acute etiologies, such as infections or uteroplacental insufficiency and chronic etiologies, such as long uteroplacental insufficiency, diabetes or immunologic rejection (Eberhard Merz, 2003)

Post term pregnancy:

Post term pregnancy is a gestation of 42 weeks or more. Symptoms include prolonged pregnancy, postdates pregnancy and post term pregnancy is problem because at this gestation the baby is at it is maximum size, and placenta is becoming more calcified, less efficient and more prone to failure. (Devin, 2005).

Intrauterine growth restriction (IUGR):

IUGR is fetal growth disorder, the most widely used definition is a fetus whose estimated weight is below the 10 percentile for it is gestational age and whose abdominal circumference is below 25th percentile, also of importance growth restricted fetuses are at risk of long term neurologic and intellectual impairment when delivered at term (probably because of chronic intrauterine hypoxia and severe academia). IUGR is generally broadly classified as being either symmetric or asymmetric (Rumack,et.al 2005)

Causes of IUGR:

There are numerous causes of IUGR which can be divided into maternal, placental and fetal factor, most common causes is:

Hypertensive disease, smoking and alcohol abuse, collagen vascular disease, poor nutrition, family history, abnormal placentation, infections, genetic disorder and multiple gestation.

And common uterine factors are fibroid and mullerian anomaly (bicornate uterus) (Rumack, et.al2005).

Bilateral renal agenesis (BRA):

BRA (Potter's syndrome) is a lethal abnormality characterized by congenital absence of both kidney and severe oligohydramnios. The reported incidence of BRA is about 1 in 4,000 birth. Neonatal mortality is attributable to severe pulmonary hypoplasia due to severe oligohydramnios associated anomalies are relatively common, especially musculoskeletal (most notably sirenomelia), and cardiovascular (Ted Rosenkrantz, 2012)

Bilateral ureteropelvic obstruction:

Ureteropelvic junction (UPJ) obstruction is the most common cause of neonatal hydronephrosis. UPJ obstruction is most often unilateral with only 10 to 30% of cases being bilateral.

Bilateral UPJ obstruction is associated with variable degree of oligohydramnios and a variable prognosis depending on the severity and duration of renal obstruction (Trish Chudleigh, et.al, 2004).

Bilateral multi cystic dysplastic kidneys:

MCDK result from very early and severe urinary tract obstruction. The bladder and AFV should appear normal with unilateral MCDK, with a contra lateral renal abnormality, the bladder may be small and there should be varying degrees of oligohydramnios (Eberhard Merz, 2003).

Infantile poly cystic kidney disease (IPKD):

IPKD is also known as PI renal cystic disease and autosomal recessive polycystic kidney disease, IPKD is an autosomal recessive disorder with a wide clinical spectrum.

IPKD involves both kidneys and the liver (hepatic fibrosis). On ultrasound, both kidneys are symmetrically enlarged (3 to 10 times larger than normal) and exhibit increase echogenicity.

Distinct parenchymal cysts are usually too small to be resolved, in most cases, renal function is severely impaired and there is severe oligohydramnios and the bladder may not be seen (Devin, 2005).

Posterior urethral valve:

The most common cause of urinary obstruction at the urethral level is (PUV), which is valve like tissue flaps in the proximal or prostatic portion of the male urethra.

The most specific sonographic finding is the (key hole sign) which describe a dilated urinary bladder with dilated proximal urethra, the bladder wall may appear abnormally thickened, and there may be bilateral hydroureteres and hydronephrosis Oligohydromnios may be mild to severe depending on the degree of obstruction (Rumach, et.al, 2005).

Chromosome defect (especially triploidy):

Triploidy result from an extra haploid set of chromosomes at fertilization with extra set of chromosome usually being paternal.

Triploidy is a random event estimated to occur in about 1% to 2% of pregnancies, with most pregnancies aborting spontaneously in the first trimester. (Ted Rosenkrantz, 2012)

Twin- to twin transfusion syndrome (T. T. T .S):

It is unequal shunting of blood from one twin to other through placental anastomatic vascular channels, in T T S, fetal blood is shunted from a donor fetus to a recipient fetus. The recipient fetus becomes cardiac overloaded, polycythemic and is at risk of congestive cardiac failure.

In contrast, the donor fetus becomes anemic, hypovolemic and develop IUGR.

Co-twin biometric discordance and amniotic fluid volume discordance (oligohydramnios associated with the donor fetus and polyhydramnios associated with the recipient fetus (TrishChudleigh, et.al, 2004).

2.5.1.2 Treatment of oligohydramnios:

Treatment of oligohydramnios by amnioinfusion, it is instillation of fluid (usually normal saline) in the amniotic cavity. This procedure may be performed in case of severe oligohydramnios to provide negative contrast for better sonographic visualization of fetal anatomy. Amnioinfusion is done with ultra sound guidance and under aseptic condition.

A fetus with poor growth those mother oligohydramnios is at high risk for complication, such as asphyxia (lack of oxygen), before and during birth.

Mother of these babies are monitored very closely. They sometimes need to be hospitalized. Some studies that women with oligohydramnios can help increase their level of amniotic fluid by drinking extra water and decreasing physical activity or bed rest. (Eberhard Merz, 2003).

2.5.2 Polyhydramnios :

Polyhydramnios or hydramnios is an abnormal or excessive amount of amniotic fluid. Prior to the widespread use of ultrasound in obstetrics, polyhydramnios was defined as an amniotic fluid greater than 2,000 milliliters based on dye dilution techniques. Based on ultrasound technique, the overall incidence of polyhydramnios is estimated to be about 1 %.(Devin, 2005)

From a clinical perspective, polyhydramnios may be suspected when the uterus is large-for-dates (abnormal increase in uterine symphysis-fundal height) in association with difficulty in palpating fetal small parts and in hearing fetal heart tones. In severe cases, the uterine w may be so tense that the obstetrician cannot palpate any part of the fetus.

Polyhydramnios is most frequently gradual or progressive however its onset may be acute and cause sudden distention of the uterus (acute polyhydramnios). In general, the more severe the polyhydramnios, the higher is the perinatal mortality rate, so that the prognosis for the infant in major degrees of polyhydramnios is poor. In large part, fetal mortality in cases s of severe polyhydramnios is related to fetal anomalies and fetal respiratory distress syndrome (the incidence of premature deliveries in polyhydramnios is about twice the overall rate). Minor and moderate degrees of polyhydramnios can usually be managers without intervention until labour starts or until the membranes rupture spontaneously. There is no satisfactory treatment for symptomatic polyhydramnios other than removal of some of the excessive amniotic fluid by amniocentesis. The main objective of therapeutic amniocentesis is relief of the mother's respiratory distress, and to that end it is successful. The major risk of therapeutic amniocentesis is premature labour and premature rupture of membranes (and the associated risk of chorioamnionitis) (Devin, 2005).

2.5.2.1 Type of polyhydramnios:

1. Mild polyhydramnios (80%).
A pocket of amniotic fluid measuring 8-11 cm or four pocket measuring 25 – 30 cm.
2. Moderate polyhydramnios:

- A pocket of amniotic fluid measuring 12-15 cm or four pocket measuring 30.1 – 35 cm
3. Severe polyhydramnios:
A pocket of amniotic fluid measuring 16 cm or more or four pocket measuring >35.1 cm (Rumack, et.al, 2005).

2.5.2.2 Maternal complication of polyhydramnios:

The major symptoms accompanying polyhydramnios arise from purely mechanical causes and result chiefly from the pressure exerted from the overdistended uterus upon adjacent organs. Polyhydramnios may cause maternal respiratory distress. When uterine distention is excessive, the mother may suffer from severe dyspnea and in extreme cases she may be able to breathe only in the upright position. Edema, especially of the lower extremities, is the consequence of compression of major venous systems by the very large uterus. Rarely, severe maternal oliguria may also result from obstruction of the maternal urinary tract by the very large uterus (Ted Rosenkrantz, 2012).

2.5.2.3 Most Common Causes of Polyhydramnios:

- Diabetes mellitus.
- Fetal anomalies:
 - a. central nervous system, e.g. anencephaly
 - b. cardiovascular, e.g. arrhythmias
 - c. thoracic, e.g. congenital diaphragmatic hernia
 - d. upper GI tract obstruction, e.g. duodenal atresia
 - e. lethal skeletal dysplasias, e.g. thanatophoric dwarfism
 - f. chromosome defects
 - g. Immune and nonimmune fetal hydrops
 - h. twin-to-twin transfusion syndrome (associated with the recipient twin)
 - i. Placental choroangioma

The various clinical and sonographic causes of polyhydramnios are covered in other sections of the course. In general, the greater the degree of polyhydramnios, the greater the likelihood of finding a major fetal anomaly and an accompanying chromosome abnormality. The combination of polyhydramnios and early onset IUGR has been reported as a sign of trisomy 18 (although oligohydramnios may also be seen with trisomy 18). With gross polyhydramnios, the placenta may appear thin on ultrasound examination owing to excessive uterine distention (Trish Chudleigh, et.al, 2004).

Diabetes mellitus:

Diabetes mellitus is a medical disease that leads to hyperglycemia (an abnormal elevation of blood glucose level) and glycosuria (glucose in urine) as the hyperglycemia increases. Diabetes is made worse by pregnancy and that increases the risks of pregnancy complication.

Diabetes mellitus (DM) classified into:

- 1- Insulin dependent diabetes (IDDM).
- 2- Non- insulin dependent diabetes (NIDDM).
- 3- Gestational diabetes (GDM).
- 4- Impaired glucose tolerance (IGT)
- 5- Diabetes associated with certain known condition and symptoms (pancreatic disease changes in hormones beside insulin, the administration of various drugs and chemical agents, insulin receptor abnormalities, genetic syndrome and malnutrition (Eberhard Merz, 2003).

Fetal anomalies:

Anencephaly is defined as absence of cranial vault higher brain (cerebrum).

It is the most common anomaly of the neural tube and results from failure of the neural tube to completely close at its cephalic and closure of the neural tube occurs between the second and third trimester weeks. After 20 to 24 weeks of the gestation, polyhydramnios is associated with about one-half of cases probably due to centrally mediated reduction in fetal swallowing, fetal polyuria resulting from insufficient production of vasopressin from the fetal pituitary and transudation of fluid across the uncovered meninges (Devin, 2005).

Fetal arrhythmias:

The arrhythmias are abnormal heart beat; any beat less than 60 beats per minute or more than 100 beats per minute. Less than about 1 minute episodes or bradycardia are common in the fetus and are not usually significant. A side from evaluating the arrhythmias one should evaluate for sign of congestive heart failure and hydrops fetalis.

Alcohol, tobacco and stress is most common causes of arrhythmias (Rumach, et.al, 2005).

Congenital diaphragmatic hernia (CDH):

CDH is the presence of abnormal viscera in the thoracic cavity due to congenital defect in the diaphragm. The size of the defect varies from a tiny opening to complete absence of the hemidiaphragm.

CDH may be unilateral or bilateral (rare). The most common defects occur on the left side posteriorly and involve herniation of the stomach and small- bowel into the left chest (90% of the cases) (Ted Rosenkrantz, 2012).

The typical sonographic feature of left sided (CDH) include:

- a. Dextroposition of the heart, in the absence of a fluid- filled stomach or bowel in the chest cardiac or mediastinal shift may be the only clear cut detectable abnormality in such cases, the stomach may not be visualized in the upper quadrant of the abdomen and there may be evidence of bowel peristalsis in the left chest supporting the diagnosis of CDH.
- b. Visualization of the fluid- filled stomach and/ or obstructed fluid – distended loops of bowel in the left chest. In some cases the stomach may be seen to cross the diaphragm.
- c. Abnormally small abdominal circumference, typically less than 10th percentile for gestational age.
- d. Polyhydramnios is typically mild or intermittent in the second trimester (Ted Rosenkrantz, 2012).

Upper GI obstruction: duodenal atresia:

The normal duodenum is usually collapsed and sonographically unremarkable, with duodenal stenosis, the portion of the duodenum proximal to the offending lesion fills with fluid and is seen a fluid- filled tubular structure which communicates with the stomach. Duodenal atresia is the most common site of intestinal atresia and is associated with the usual cause of duodenal obstruction associated with the characteristic sonographic (double bubble) sign (Trish Chudleigh, et.al, 2004).

Esophageal atresia (EA):

EA is congenital absence of a segment of the esophagus. When EA occurs, it is most often accompanied by tracheoesophageal fistula (TEF) (Eberhard Merz, 2003).

Immune and non-immune fetal hydrops:

Fetal hydrops or fetalis defines as a fetus with pathological accumulation of fluid in two or more body cavities or tissues including subcutaneous edema (thick skin), placental edema (thick placental), peritoneal cavity (ascites), pleural space (plural effusion or hydrothorax), pericardial space (pericardial effusion), and polyhydramnios (Devin,2005).

2.5.2.4 Treatment of polyhydramnios:

When routine ultrasound examination shows evidence of polyhydramnios, a women’s health care provides may recommend aspiration of amniotic fluid (amniocentesis) under direct continuous real time ultrasound monitoring in order visualize the path of the long 20 gauge needle during insertion and to monitor the location of needle tip in selected pocket of amniotic

fluid, it take over 30 to 45 minutes. In many cases slight polyhydramnios goes away without treatment. In other cases, it may resolve when the problem causing it corrected.

Health care provides usually closely monitor women with polyhydramnios weekly, ultrasound examination to check amniotic fluid levels. Test of fetal well-being also are recommended to check for signs of fetal difficulties.

If the pregnant women becomes too uncomfortable because of the extremely large volume of fluid, her provides may recommended treatment with indomethacin. This drugs helps reduce fetal urine production and reduces amniotic fluid level.

If the test show that the mother and baby are healthy, a women with slight polyhydramnios near term usually does not need treatment. Early studies suggested the therapeutic benefit of indomethacin in treatment of polyhydramnios, not typically used in third trimester due to affects of in-utero narrowing of the fetal ductus arteriosus which result in pulmmonary hypertension postnatally(Devin,2005).

2..6 Previous Studies:

The AFI is semiquantative analysis of AFV described first by Phelan in 1987 (Wikipedia, 2013).

The technique is simple acceptable reproducible and also readily usable even by people with limited experience of U/S technique.

Using Moore and Cayle technique the AFI is obtained with the patient in supine position. The abdomen is divided in to four quadrants are defined sagittaly by linear nigra for right and left, and the umbilicus for upper and lower. The U/S probe is positioned parallel to the patients segital plane.

Measurement in each pocket should be clear of umbilical cord and fatal small parts. AFI is the sum of these four quadrants (Wikipedia, 2013)

Several studies on AFI has demonstrated serial change of mean AFI values weekly with the threshold for oligohydramnios and polyhydramnios during pregnancy.

The values described by Moore and Cayle are used worldwide. The cut off valuable for the AFI commonly used are on AFI of 0-5cm labeled as low fluid, 5.1 to 8cm as normal fluid and greater than 8cm as high fluid value (Moore&Cayle, 2011).

Study of 400 Pakistanie women the antenatal clinic at Kharadar General Hospital, from March 2004 August 2005, these women came for routine cheek ups.

Obstetric history of all women was taken on a prescribed form , Gestation age was estimated , on the basis of last menstrual period and U/S scan ,inclusion criteria were singleton gestation with no fetal anomalies and gestational age between 20 -41 weeks , no women with medical (chronic hypertension , diabetes mellitus , collagen vascular disease,twin hemoglobinopathy) or obstetric(preterm labour , preterm rupture of membrane , gestational diabetes , preeclampsia

, intra-uterine growth retardation , gestational age less than 60 week) each patients underwent a single ultrasonic examination , all AFI estimation was done by the same ultrasonologist and a single obstetrician to eliminate inter-observational error(Habiba,2005) .

The technique of Moore and Cayle were used to measured AFI , patients were examined in supine positional, the uterus was divided in to four quadrants , the U/S probe kept perpendicular to the plan of floor and longitudinally with maternal spine , vertical depth of the largest clear AF pool was taken which was `free of umbilical cord or foetal limbs , the pool measurement was done in cm from each quadrant of uterus , AFI estimated by adding four quadrant depth ultrasonic examination was performed using ultrasonic with 3.5 MHz linear transducer (Habiba,2005).

The study shows that 134 were primigravida and 266 were multigravida. Age of women ranged from 18 to 40 years, and in patients with preterm and term gestation. The AFI values were higher in the preterm gestations compared to those obtained in term gestation ($p < 0.0001$), the mean AFI was 12.8cm. The data was normally distributed with mean and median almost the same, the 5th percentile was taken as lowered limit and 95th percentile was taken as upper limit of normal AFI, 7cm AFI as lower limit of normal and 18cm AFI as upper limit of normal at term. For preterm gestational period the upper and lower limit of normal AFI were 10cm to 20cm respective by higher than that in the term gestational (Habiba,2005).

Study done by Rutherford et al and Phelan et al proposed a range of normal AFI of 8 to 18cm .However as AFI values may be affected by the difference of race and environment, care should be taken when previously established. AFI values are applied to pregnant women with different racial and environmental back grounds. The objectives of the present study were to establish the normal range of gestation specific (Mowda, 2014)

Other study of uncomplicated pregnant Pakistani women in gestational age between 20-40 weeks, the study shows that AFI rises to peak at 27 week, other studies, shows another peak at 30-31 week. The values then begin gradual fall to 40 weeks gestation (Habiba, 2005)

Study done by Phelan and Moore in GA (week) 18, 21 ,23 , 25 ,27 ,29 ,31 ,33 ,35 ,37,39 in normal Pakistani women ,founded plateau between 27 and 38 week gestation before declining . Out results suggest that we could define mild oligohydramnios or alarm point at 40weeks, when AFI is less than 7cm .This is similar to as described by Moore and Calye .The alarming values is 6cm in a study done on Indian women while ,in Chinese population the lower limit is described as 5 -6 cm (Ph) .

Salahuddin , et .al. reported peak at30 week in their study from Japan ,the study on Indian woman suggests peak at 27 week. Other investigators found the same rise in AFI to peak at 26weeks gestation followed by a progressive decline to 42 weeks. The similarity of this study to previous ones is only in the trend but the absolute values differ from the established reference ranges in other populations (Mowada, 2014).

The result of study of Pakistanis women are similar to those for described for Caucasian but

slightly higher than those for Indian and Chinese women. The study of India and Chinese shows 7cm as lower limit of normal .For preterm gestation the upper and lower limits normal were 9 and 19cm respectively and are higher than at term gestation (Mowada, 2014).

Study done by khadikar , et al study group of Indian women in GA between 24 – 40 week with normal pregnancy study show that an initial peak at the 26th week gestation and gradually falls until term .(Kevin ,2003)

Longitudinal study was undertaken to characterized the change in AFV in normal pregnancy by Chauhan , Roberts ,Martin, Magann , and Morison (1999) .Selection of 75 patients without pre – existing medical or obstetrical complication was completed over a two year period for AFI measurement with routine prenatal visits , mean age of participant was 26.6 +/- 4.5 years ,with mean gravidarity as 2.1 , eighty seven were caucasin,11% African –Americans , and 2% oriental .All examination were performed by one obstetrician and one sonographer starting, at 24 weeks gestation ,measurements were done in non – laboring patients with intact membranes , data was analyzed by stratifying the AFI value over gestation age ,the mean AFI value for preterm ,< 37 gestation term ,37 – 40 full weeks and post term > 41 weeks gestation .Nineteen patients were later excluded secondary to the development of a medical and / or obstetrical complication .Of the 56 patients remaining the results show the AFI volume increases slightly between 24 and 37 week gestation , plateaus until 40 weeks gestation ,then follow a steady decline

The authors that the AFI is a simple , semi quantitative and reproducible method of assessing AFV utilizing a longitudinal design ,mean AFI is not significantly different between 24 and 40 weeks of gestation ,after 41 weeks of gestation a significant difference in the AFV is noted , the purpose in deriving normative data on how the AFI changes with gestational age is to provide investigators with the ability to generate a regression equation correlating AFI changes with gestational age ,this mathematical model may help predict which patient will subsequently develop oligohydramnios or polyhydramnios , the important of determining what constitutes normal fluid level dependent on gestational age is necessary in order to enable us determine what risks may be associated with changes in AFI , while this may study supports that fluid levels are relatively constant until after 41 weeks gestation ,the study group was relatively small ,stressing the need for further evaluation of uncomplicated pregnancies and associated AFI ,this study only addressed AFI variation throughout pregnancy and did not provide any correlation to outcomes expected or actually obtained(Mowada,2014)

Wing , Fishman , Gonzalez and Paul (1996) .Evaluated AFI from the perspective of determining the frequency of assessments in ante partum testing in order to identify patient at risk , a retrospective analysis of data accumulated over a one year period at Los Angeles Country- University of southern California Medical Center ante partum testing until was completed .The ante partum testing until was completed .The ante partum testing performed consisted of a modified biophysical profile and obtaining AFI, the four pocket method of

assessing FV was utilized with oligohydramnios being classified as a total of 5.0cm or less ,low normal AFI values ranged from 5.1 -8.0 cm and normal values were 8.1 to 24cm for statistical evaluation preterm was defined as < 37 weeks estimated gestational age , 37 -40 completed weeks was term and greater than 41 weeks was considered post term , AFI values were performed at 4 -4- day intervals .With follow up value compared .Of 11,827 AFI values obtained ,6291 had follow –up values within 40 days . Patients were excluded from the measurements, spontaneous premature rupture of membranes, twin gestations, or anomalous fetuses.

Finding of this noted post term pregnancies to have a greater risk of developing oligohydramnios .The post term group was noted to have a greater chance of developing oligohydramnios when compared with preterm group at both low – normal levels and the term group at the normal level .Statistically there was a 1.7% chance for oligohydramnios developing within 4days in those pregnancies less than 41 weeks supporting once weekly screening for those patients with known risk factors .There was noted to be a 25% per week decline in AFI in those pregnancies greater than 41 weeks gestation .The author feel these findings support the need for AFI measurements weekly provided the previous measurement was greater than 8cm and the gestational age is less than 41 weeks in those pregnancies with other noted risk factors . This study does demonstrate the stability of AF levels in those pregnancies less than 41 weeks, even with level consider to be low – normal and recommends minimal interventions for these patients. (Wikipedia, 2013).

In determining the importance of changing fluid levels in the otherwise uncomplicated pregnancy one needs to consider the possibility of decreasing fluid being a normal progression of a healthy pregnancy. During the second trimester, evaluation of AF is important, since alterations and in its volume associate with fetal anomalies and per natal complications .For better interpretation of AFI, it is essential to have normal reference values for this index .Indeed, since these values vary with the gestational age, the normal reference should be determined for various weeks of pregnancy (Mowada, 2014)

Study appear in 2013 in AL –ZAEIM AL-AZHARI, which done by Mowada Mohammed Osman.

Methodology:

Trans abdominal ultrasound scanning done to assess AFV in pregnant patient in second and third trimester.

Result:

- 1- Most of the pregnant ladies have normal AFV.
- 2- AFI rises to peak at 36 week (13.69) cm and gradually declined to (6.42) cm.
- 3- The main AFI from 24-40 weeks gestation was 10.06 cm

Chapter three
Materials and Methods

Chapter three

Materials and Methods

3.1 Materials:

3.1.1 Machines used:

Toshiba 200, transabdominal Convex probe 3.5MHz

General Electric, transabdominal Convex probe 3.5MHz.

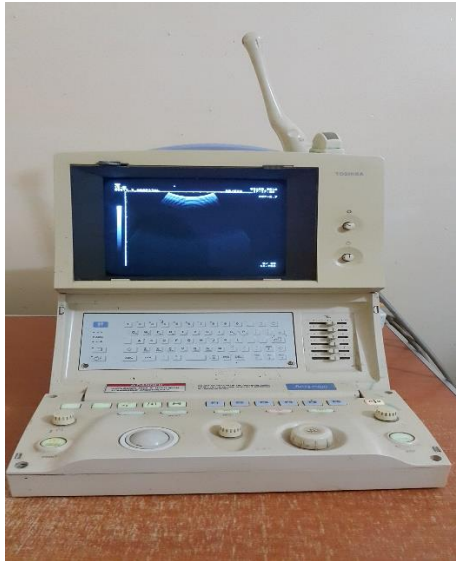


Figure (3.1). Shows Toshiba 200 machine



Figure (3.2). Shows General electric LOGIQ 5

3.1.2 Population:

The study population was composed of 90 pregnant women in their second and third trimester presented to the ultrasound section in Kosti Teaching hospital and some other diagnostic health and private centers, during the period from first of August to thirty of December 2015.

3.1.3 Included criteria:

The patient were scanned in second and third trimester with normal and abnormal AFV.

3.1.4 Excluded criteria:

All pregnant women in first trimester and multiple pregnancy were excluded.

3.2 Methods:

3.2.1 Patient preparation:

This procedure requires little to no special preparation. Since only lower abdominal area needs to be exposed for this exam, the patient may want to wear a loose-fitting, the piece of outfit. The case examined while reclining with the abdomen exposed particularly late in pregnancy, this may not be a comfortable position for the client who can experience, symptoms from IVC compression by gravid uterus. Woman in this position should be watched carefully for agitation shortness of breath, dizziness or faintness. Should any of these symptoms occurs roll the patient on to her side and the symptoms will usually disappear within a few seconds. Once she feels better you can have her rule back, or partially back to continue the scan. Scanning is usually done in dim light room, minimize the reflected glare off the screen.

3.2.2 Technique and Methods of assessment:

The U/S image had been obtained for all pregnant women in second and third trimester come to obstetric and gynecological department.

- Patient position supine.
- Apply coupling agent (gel).
- Use high frequency 3.5 MHz transducer.
- Ultrasound procedure used to assess the amount of amniotic fluid. The AFI is measured by dividing the uterus in to right and left halves. The umbilicus serves as the dividing point for the upper and lower halves .(Figure 3-3)

The transducer is kept parallel to the patient longitudinal axis and perpendicular to the floor .The deepest ,unobstructed ,vertical pocket of fluid is measured in each quadrant in centimeters .(Figure 3-4) .The four pocket measurements are then added to calculate the AFI . Normal AFI values ranges from 8-25 cm.



Figure (3.3). Shows AFI measurement

3.3 Data analysis:

The data were analyzed using SPSS statistics.

3.4 Ethical consideration

- No identification or individual detail were published.
- No information or patient details will be disclosed or used for reasons other than the study.

Chapter Four

Results

Chapter Four

Results

The study was done to evaluate of amniotic fluid volume in pregnant women in second and third trimester by ultrasound

Age group (years)	No	Percentage
< 20	12	13.33
20 – 30	50	55.56
31 – 40	26	28.89
41 – 50	2	2.22
> 50	0	0
Total	90	100%

Table (4.1) shows maternal age distribution:

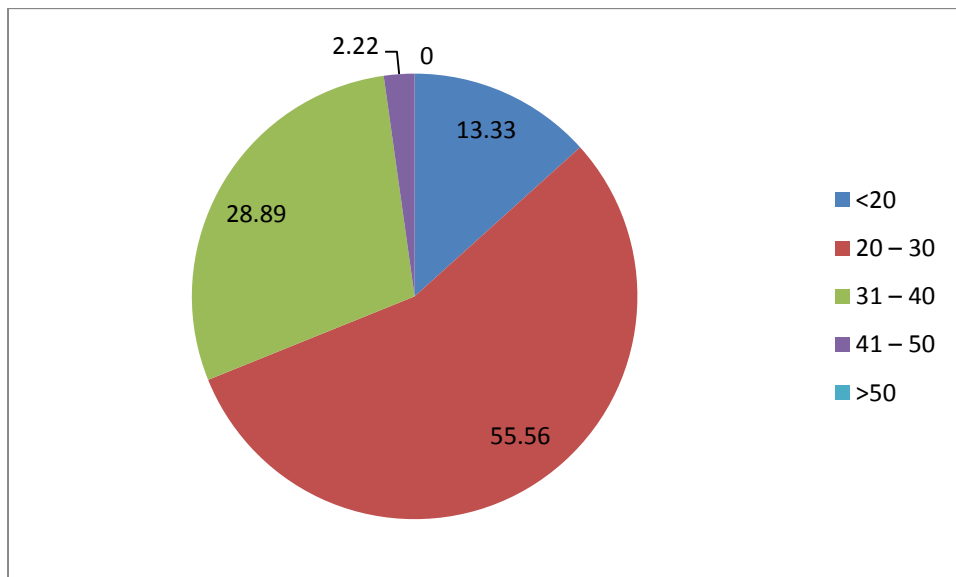


Figure (4.1) represents maternal age distribution

Occupation	No	Percentage
Employee	18	20%
House wife	72	80%
Total	90	100%

Table (4.2) shows maternal occupation group distribution:

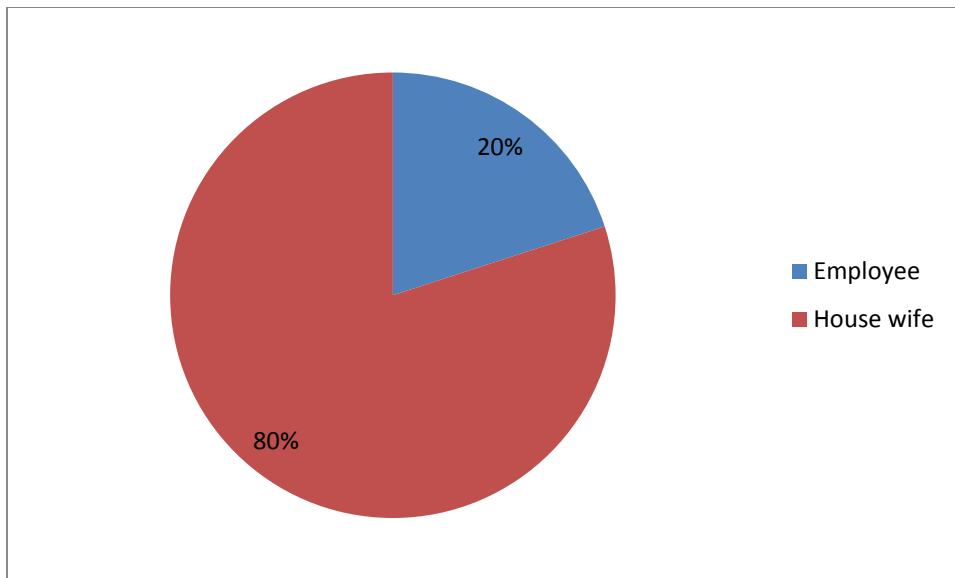


Figure (4.2) represents maternal occupation group distribution:

Occupation	No	Percentage
Primigravid	42	46.67
Para 1 – 4	27	30
Grandmulti-para	21	23.33
Total	90	100%

Table (4.3) Shows parity group distribution:

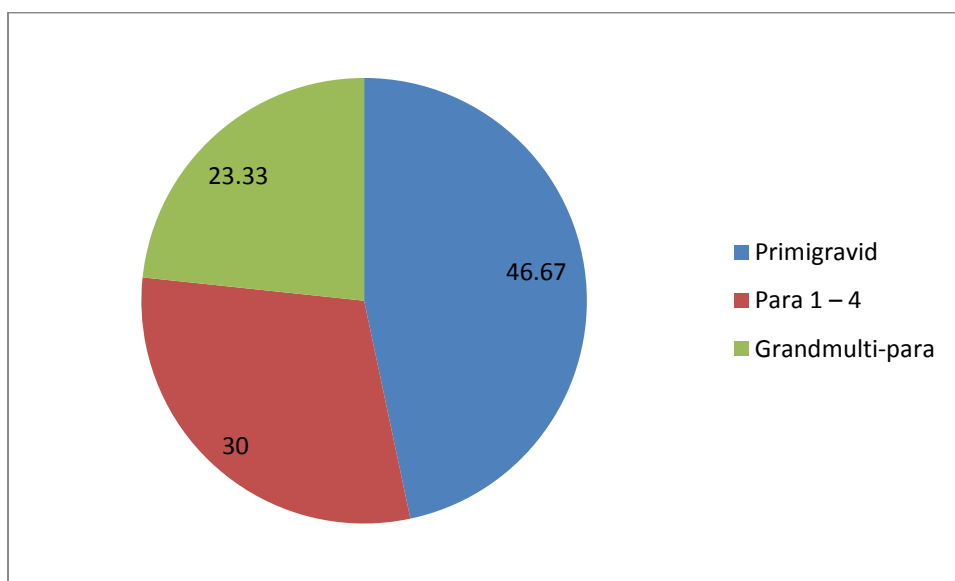


Figure (4.3) Represents parity group distribution:

GA	No	Percentage
< 25	3	3.33
25 – 29	20	22.22
30 – 34	35	38.89
35 – 39	27	30
40 – 44	5	5.56
Total	90	100%

Table (4.4) Shows Gestational age group distribution:

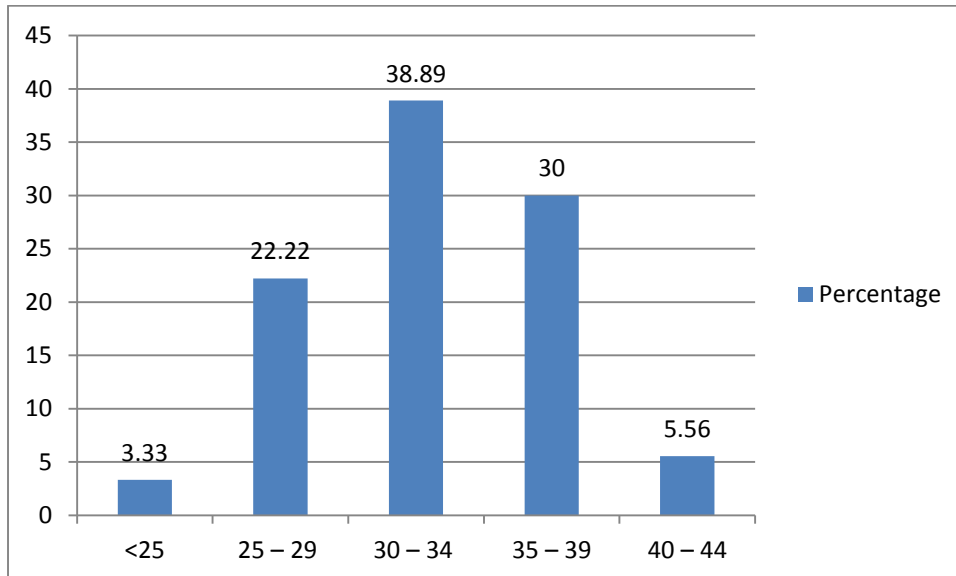


Figure (4.4) represents Gestational age group distribution:

AF	No	Percentage
Normal	80	88.89
Increase (Polyhydromnios)	4	4.44
Decrease (Olighydromnios)	6	6.67
Total	90	100%

Table (4.5) Shows Amniotic fluid group distribution:

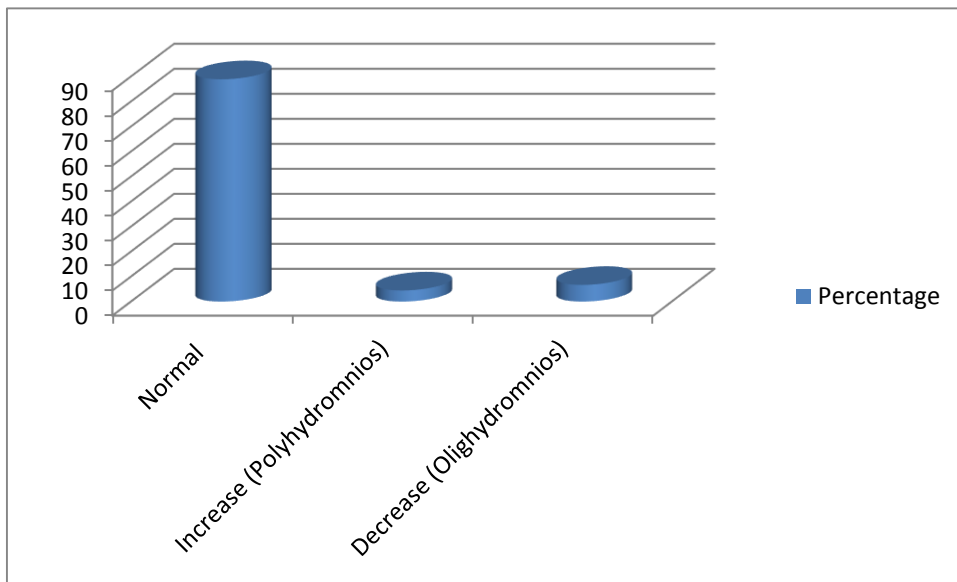


Figure (4.5) represents Amniotic fluid group distribution:

Gestation age (weeks)	Mean	Standard deviation	Minimum	Maximum
24 (n = 3)	14.33	2.52	12.3	17.3
25 (n=2)	13.50	4.24	10.5	16.5
26 (n=3)	14.67	6.66	8.7	21.7
27 (n= 4)	14.05	5.59	8.8	21.7
28 (n=6)	14.33	2.66	10.6	18.8
29 (n=5)	14.43	4.36	8.6	20.1
30 (n=5)	12.80	4.86	8.5	21.2
31 (n=5)	12.12	3.27	8.2	17.2
32 (n=11)	11.73	4.56	8.1	21.1
33 (n=2)	11.75	7.07	8.6	18.9
34 (n=8)	11.38	3.99	8.4	20.7
35 (n=3)	11.33	4.93	8.1	16.7
36 (n=6)	11.25	2.32	8.2	14.9
37 (n=3)	11.17	0.96	9.5	12.3
38 (n=6)	10.88	1.79	8.2	13.6
39 (n=3)	10.33	2.08	8.3	12.5
40 (n=3)	8.33	0.577	8.1	8.7
Total (80)	(12.06)	(3.79)		

Table (4.6) Shows Mean amniotic fluid index (cm) of normal pregnant ladies (n= 80) according to gestation age

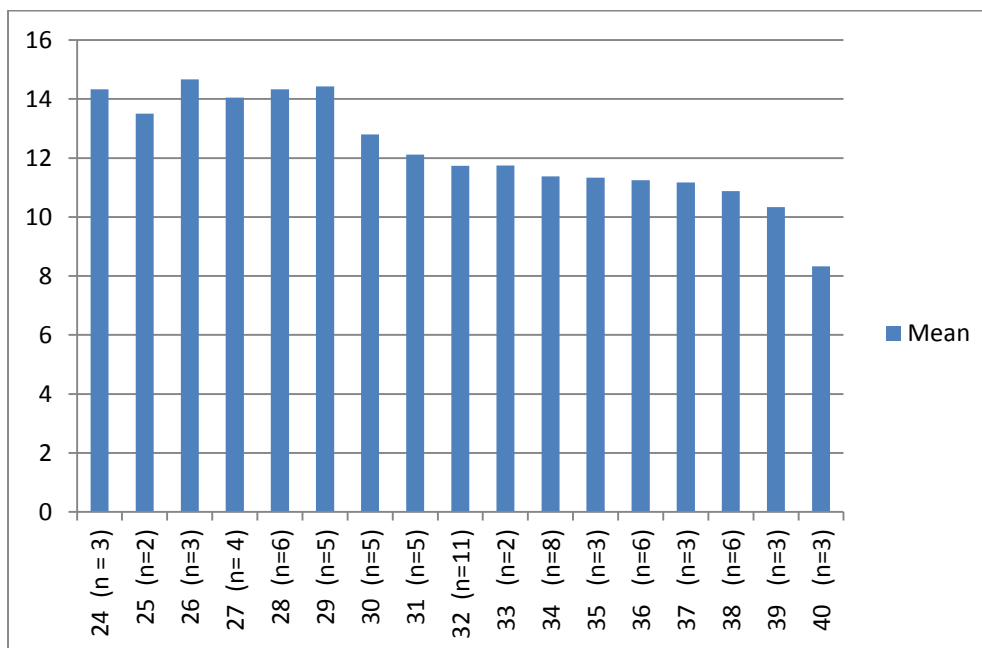


Figure (4.6) Represents the Mean amniotic fluid index (cm) of normal pregnant ladies (n= 80) according to gestation age

Most causes of polyhydromnios	No	Percentage
Diabetic mother (maternal)	1	25
Unknown reason	2	50
Fetal anomaly (fetal)	1	25
Total	4	100%

Table (4.7) shows the most causes of polyhydramnios in 4 cases:

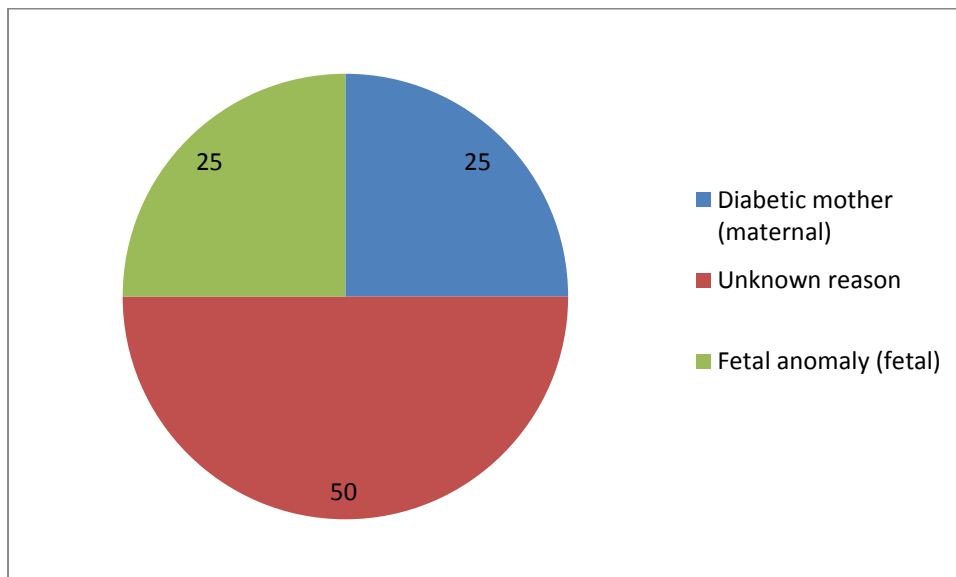


Figure (4.7) represents the most causes of polyhydramnios in 4 cases:

Most causes of Oligohydramnios	No	Percentage
Premature rupture of membrane (maternal)	3	50
Post- term pregnancy (maternal)	1	16.67
Maternal health condition (maternal)	2	33.33
Intra- uterine growth retardation (fetal)	0	0
Chronic fetal death	0	0
Total	6	100%

Table (4.8) Shows Most causes of Oligohydramnios in 6 cases:

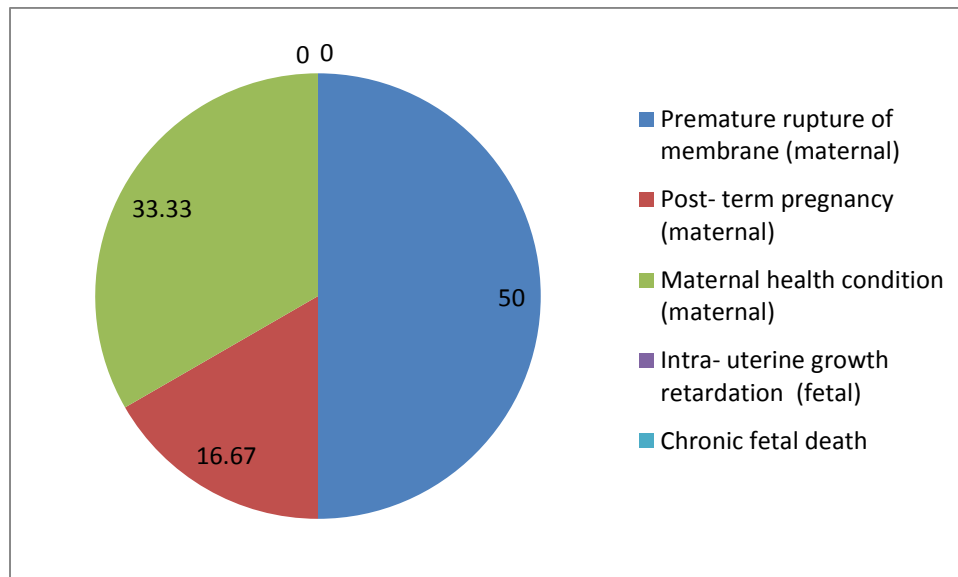


Figure (4.8) Represents Most causes of Oligohydramnios in 6 cases:

Type	No	Percentage
Mild	2	50.0
Moderate	1	25.0
Severe	1	25.0
Total	4	100%

Table (4.9) Shows Types of Polyhydramnios in 4 cases:

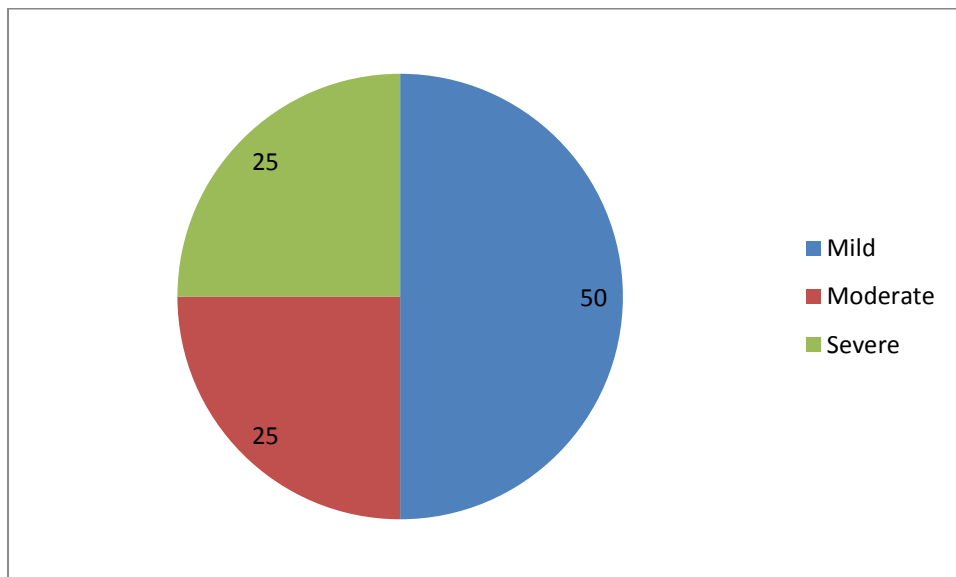


Figure (4.9) Represents Types of Polyhydramnios in 4 cases:

Type	No	Percentage
Mild	0	0
Moderate	0	0
Serve	6	100
Total	6	100%

Table (4.10) Shows types of oligohydramnios in 6 cases

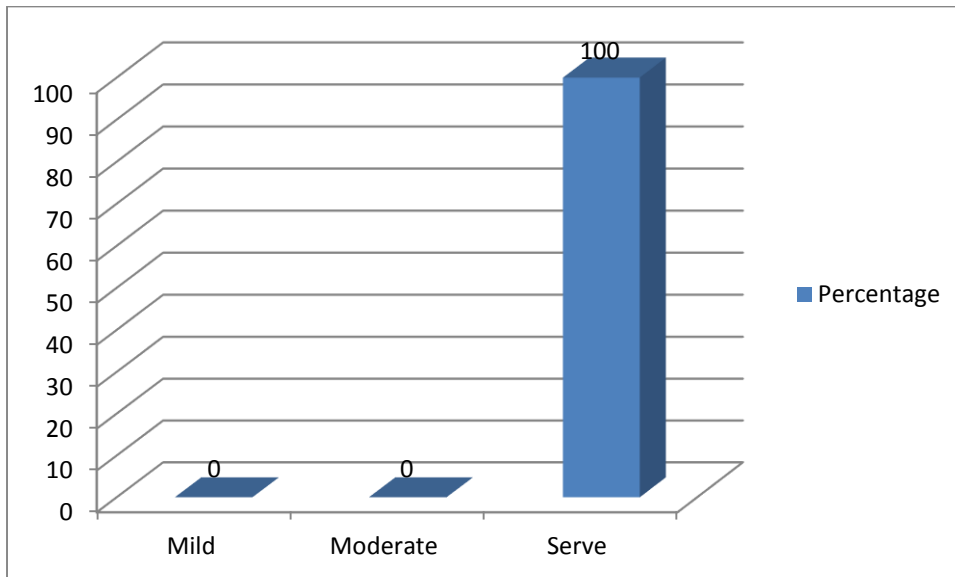


Figure (4.10) Represents types of oligohydramnios in 6 cases

Chapter five

Discussion, Conclusion and Recommendation

Chapter five

Discussion, Conclusion and Recommendation

5.1 Discussion:

Amniotic fluid is the product of complex and dynamic fetal and placental physiologic process. Disruption of the fine balance may result in over production or under production of fluid. Therefore, alterations in AFV serve as important markers of both in utero developmental defect as well as physiological responses to fetal hypoxemia and other metabolic disturbances such as maternal / fetal hyperglycemia. Both polyhydromnios and oligohydromnios may be associated with congenital anomalies. Although the ultrasonographic diagnostic criteria have yet to be firmly established, it is apparent that both subjective and objective criteria have been used successfully to identify these condition. Polyhydramnios, particularly when severe and detected early in gestation, can be treated and antenatally with serial amniocenteses. Olighydramnios with intact membranes, especially when severe and in the absence of anomalies, it usually managed by delivery, however, further research is indicated to delineate management guidelines.

AFV remains an important component of any obstetric ultrasonographic examination (Moaz (2011).

Assessment of AFV is an essential part of antenatal care. Fluid volume can also vary in every pregnant of different population and large variation are noted to occur within the same pregnancy on serial measurements with the greatest variation occurring in the third trimester (Moaz, 2011).

The main objective of this study was to evaluate the AFV by U/S in pregnant women in second and third trimester. Total of 90 pregnant women were studied from first of August to thirty of December 2015, amniotic fluid indices were measure by routine ultrasound scan. The range of maternal age from <20 to 50 years with gestational age from 24 – 40 weeks .Data analysis was performed with SPSS.

As shown in table (4-1) Figure (4-1).out of 90 cases in this study 12 cases (13.33%) their age is less than 20 years , 50 cases (55.56) their age group between (20-30)years , 26 cases (28.89%) their age group between (31-40)years ,2 cases (2.22%) their age group between (41-50)years.

Table (4-2) Figure (4-2). Shows that 72 pregnant women (80%) were house wife, 18 pregnant women (20%) were employee .

The table (4-3) Figure(4-3) illustrates that out of 90 cases in this study 42 (46.67%) were primigravida , 27 (30%) were para 1-4 ,21(23.33%) were multi para.

Table (4-4) Figure(4-4) shows that out of 90 cases in this study 3 cases at gestational age less than 25 weeks (3.33%) ,20 cases (22.22%) at 25-29 weeks ,35 cases (38.89%) at gestational age (30-34) ,27 cases (30%) at gestational age between 35-39 weeks , 5 cases (5.56%) at gestational 40 weeks ..

Table (4-5) Figure (4-5).indicates that out of 90 pregnant women in this study 80 pregnant women were normal AVF (88.89%), 4 pregnant were increase in AFV (4.44%), 6 pregnant women were decrease in amniotic fluid (6.67%).

Chart of normal AFI of pregnant women from 24 weeks gestation to 40 weeks gestation is made in this study .Table (4-6).Figure (4-6).

The study shows that Polyhydramnios occurs in (4.4%) and Oligohydramnios occurs in (6.6%) out of 90 pregnant women.

In this study unknown reason of polyhydramnios is the most common cause (50%), however diabetes (maternal causes) is (25%) and fetal anomalies (fetal causes) is (25%). Table (4-7).Figure (4-7).

Also premature rupture of membrane is the most common cause of Oligohydramnios, which occur in (50%), maternal health condition (hypertensive women) (33.33%) and post term pregnancy is (16.67%)

Table (4-8), Figure (4-8).

In this study out of 4 pregnant ,2 have mild polyhydramnios(50%) ,one have moderate (25%),and one have severe polyhydramnios (25%) .

Table (4-9), Figure (4-9).

Table (4-10) Figure (4-10).indicates that 6 out of 6 pregnant have a severe type of oligohydramnios (100%).

The study shows that most of pregnant women have normal AFV (88.9%) and few others have abnormal AFV (11.1%).

In this study normal AFI rises to it is peak at 26 weeks of gestation with AFI (14.67) cm and gradually fall until 40 weeks of gestation AFI (8.33) cm.

The study agrees with the results of Mowada Mohammed Osman research, AL-ZAEM AL-AZHARI UNIVERSITY- Sudan.

5.2 Conclusion:

This study shows that most pregnant women have normal amniotic fluid volume and abnormal amniotic fluid volume is not common finding. The study shows that the mean of normal AFI from 24 weeks gestational age to 40 weeks gestation age in pregnant women, is 14.33 cm at 24 weeks gestation then it reach it peak of 14.67 cm at 26 weeks gestation and gradually declined to a mean of 8.33 cm at 40 week gestation.

Normal amniotic fluid in 88.9% and abnormal occurs in 11.1%.

In abnormal amniotic fluid Polyhydramnios occurs in 4.4% and oligohydramnios occurs in 6.7% of 90 pregnant women.

The study shows that most causes of Polyhydramnios are of unknown reason and most causes of oligohydramnios are due to Preterm Premature Rupture of Membranes. Mild and moderate types of Polyhydramnios are common types and severe form is the common type of oligohydramn

5.3 Recommendation:

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

- 1- Assessment of amniotic fluid volume is an essential for antenatal care and follow up by ultrasound should be done in all pregnant ladies to predict prenatal complication .
- 2- Amniotic fluid must be assess by ultrasound method and not depend only on the observation of the sonographer to prevent missing amniotic fluid volume abnormality.
- 3- For better interpretation of AFI, normal reference values for this index in various weeks of pregnancy in sundaes pregnant ladies are needed.
- 4- A single deepest pocket method should be at least used, as it is simpler to perform and less time consuming.
- 5- Early diagnosis and better management of fetal abnormalities reduce incidence of polyhydramnios and oligohydramnios.
- 6- Further studies are recommended for providing more accurate estimates of the normal range of amniotic fluid index in Sudanese

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Appendix

Sudan University of Science and Technology

College of Graduate studies

Data Collection Sheet

Assessment of AFV in Pregnant Women in Second and Third Trimester

- Age: <20 () 20-30() 31-40() 41-50 () >50 ()
- Occupation: Employee () House wife () others ()
- Parity: primigravida (para 1-4 () grand multi para ()
- LMP: GA: EDD:
- The AF is:
Normal () Increase () Decrease ()
- The Measurement of AFV
AFI () Cm.
- **Maternal** Cause of poly hydramnios:
 1. Diabetic Mother ()
 2. Unknown reasons ()
 3. Others ()
- **Fetal causes of poly hydramnios**
 1. Fetal anomaly ()
 2. Fetal infection ()
 3. Twin — Twin transfusion syndrome ()
 4. Others ()
- **Maternal causes of oligohydramnios**
 1. Pre mature rupture of membrane ()
 2. Post term pregnancy ()
 3. Maternal health condition ()
 4. Placenta problem ()
 5. Others ()
- **Type of poly Hydromnos**
 1. Mild ()
 2. Moderate ()
 3. Severe ()
- Type of oligohydromnios
 1. Mild ()
 2. Moderate ()
 3. Severe ()



Figure (1) ultra sound image shows 25 years old pregnant woman with 36 weeks gestation with normal AFV

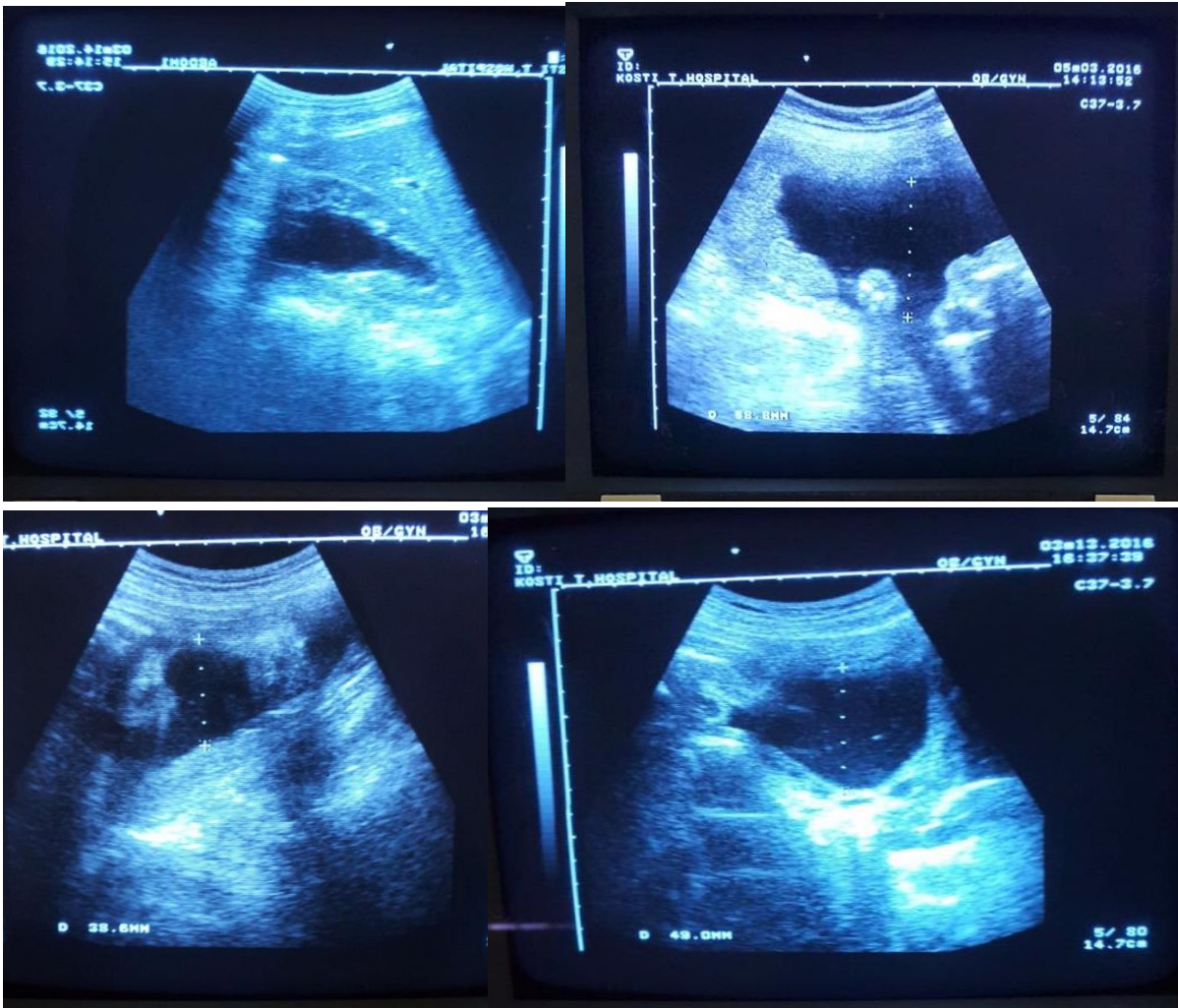


Figure (2) image shows 32 years old pregnant woman with 28 weeks gestation with normal AFV

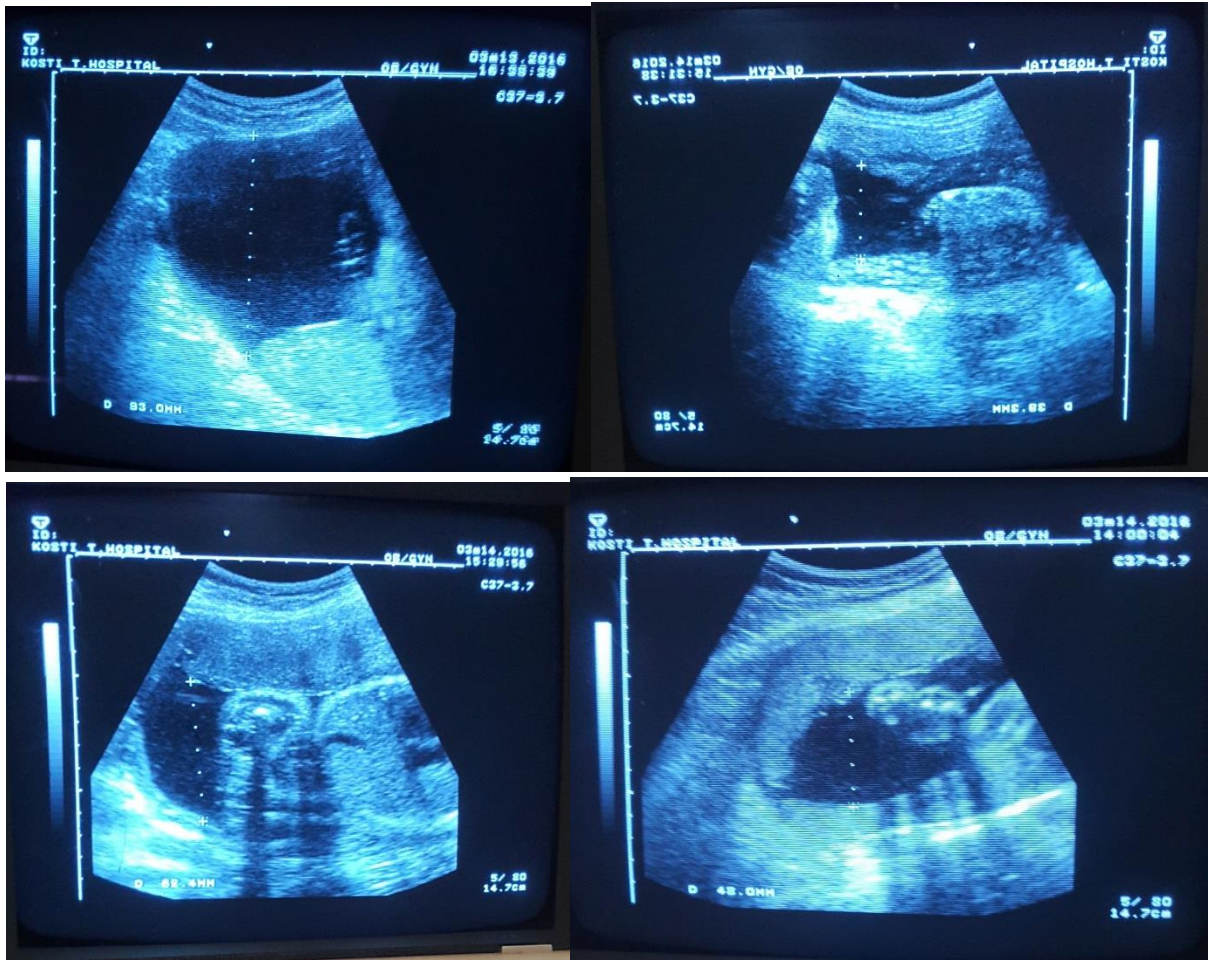


Figure (3) ultra sound shows 20 years old pregnant woman with 30 week gestation with normal AFV

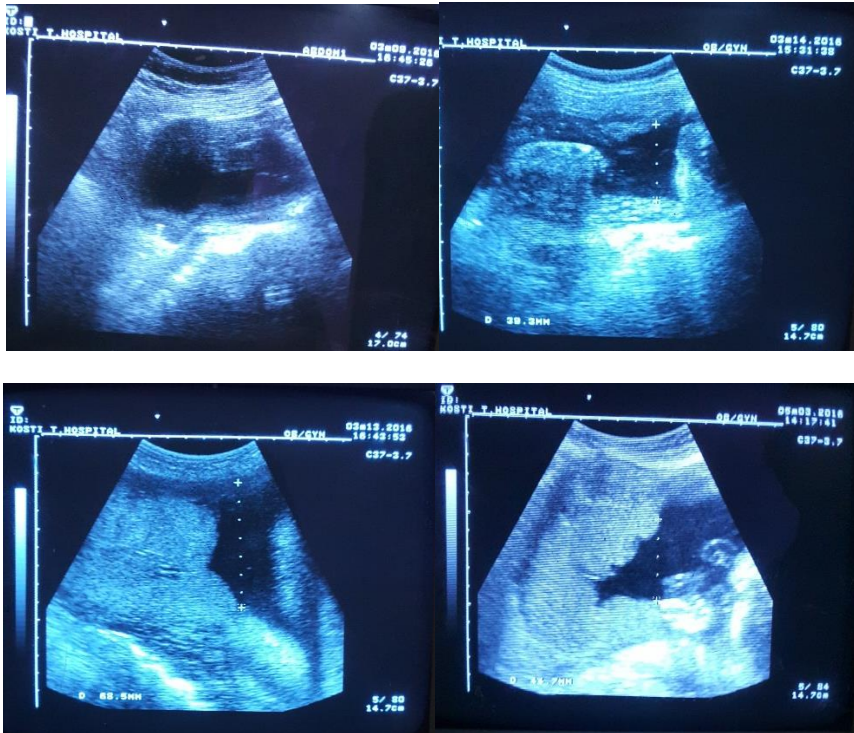


Figure (4) ultra sound image shows 34 years old pregnant woman with 32 weeks gestation with normal AFV



Figure (5): ultra sound image shows 28 years old pregnant woman with 26 weeks gestation with normal AFV



Figure (6): ultra sound image show 30 years old pregnant woman with 38 weeks gestation with normal AFV



Figure (7): ultra sound image shows 24 years old pregnant woman with 39 weeks gestation with normal AFV.



Figure (8): ultra sound image shows 36 years old pregnant woman with 28 weeks gestation with polyhydramnios due to unknown reason

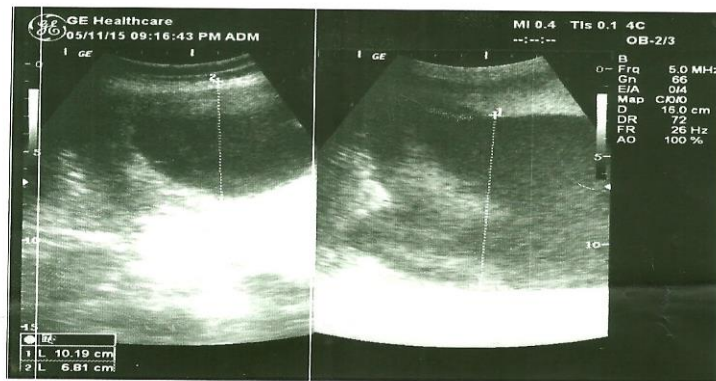


Figure (9): ultra sound image shows 40 years old pregnant woman with 32 weeks gestation with polyhydramnios due to D.M

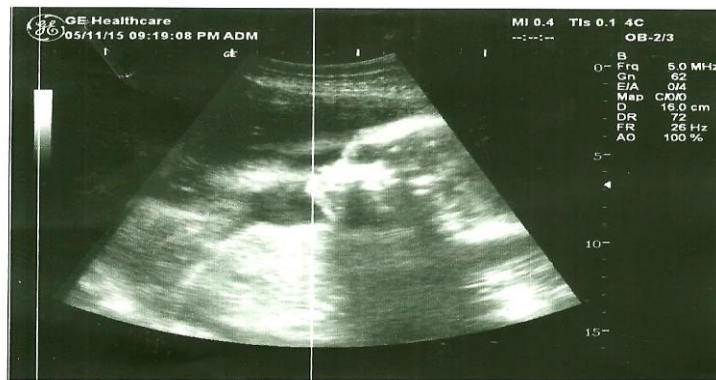


Figure (10): ultra sound image shows 34 pregnant woman with 29 weeks gestation with polyhydramnios due to unknown reason



Figure (11): ultra sound image shows 25 pregnant woman with 40 weeks gestation with oligohydramnios due to post date

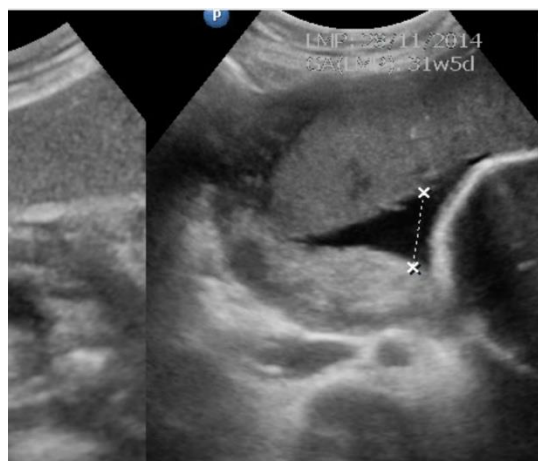


Figure (12): ultra sound image shows 30 years old pregnant woman with 32 weeks gestation with oligohydramnios due to premature rupture of membrane



Figure (13): ultra sound image shows 27 years old pregnant woman with 30 weeks gestation with oligohydramnios due to premature rupture of membrane