Sudan University of Science and Technology

College of Graduate Studies

Evaluation of Normal Amniotic Fluid Volume in the Second and Third Trimesters using Ultrasonography for Sudanese Women in Khartoum State

تقويم الحجم الطبيعي للسائل الامنيوني في الفترتين الثانية والثالثه للحمل باستخدام التصوير للموجات فوق الصوتيه للنساء السودانيات

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

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Dedication

THIS WORK IS DEDICATED
TO MY FATHER
TO MY MOTHER
TO MY HUSBAND
MY BROTHER
TO MY SISTER AND MY KIDS
AND TO ANYONE WHO ASSISTED TO COMPLETE THIS WORK .

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I would like to thank Dr. IkHLAS ABDELAZIZ , my supervisor for her kind advice in my study**.**

My thank must go to the ultrasound department of Ribat University Hospital & Omer sawi complex, thank them for their good support during collection of data .I gratefully would like to pass my special thanks to my friends and colleagues who helped me.

Abstract

The study was descriptive and analytic carried out to assess the amniotic fluid volume in Sudanese pregnant women in Khartoum state in second and third trimester. The study was conducted on 50 pregnant women in their second and third trimester over a period from September 2018 to December 2018 in university Ribat Hospital &Omer sawi complex, depended on the international study protocol in obstetrical scanning. All pregnant women were subjected to be examined by Ultrasound scanning using SEMENSE and MINDERY scanner with 3.5MHz convex probe Trans abdominal scanning and were performed for all pregnant women and the amniotic fluid volume was measure using, the deepest pocket (large pocket) methods.

The study found that most of the pregnant women had normal amniotic fluid (94%) and few others pregnant women had an abnormal amniotic fluid (6%). Amniotic fluid must be assessed by ultrasound method and not depending only on the observation of the sonographer to prevent missing amniotic fluid volume abnormality.

المستخلص

أجريت هذه الدراسة بغرض قياس حجم السائل الامنيوني حول الجنين للنساء السودانيات الحوامل بولاية الخرطوم في الفترة الثانية والثالثة من الحمل باستخدام الموجات فوق الصوتية. هدفت الدراسة لتحديد القيمة العادية لمؤشر السائل الامنيوني للنساء الحوامل في الفترة الثانية والثالثة من الحمل، ومعرفة الاسباب التي تؤدي إلى التغيرات غير الطبيعية من زيادة أو نقصان. تم جمع البيانات وتصنيفها وتحليلها من عينة مكونة من خمسين أمرأه في الفترة الثانية والثالثة من الحمل، باستخدام برنامج الحزمة الاحصائية للعلوم الاجتماعية، وأجريت في مستشفى الرباط الجامعي ومجمع اللواء عمر ساوي في الفترة من سبتمبر 2018م حتى نهاية ديسمبر 2018، وجميع النساء الحوامل تم فحصهن بالموجات فوق الصوتية باستخدام جهاز سيمنس ومندري مع محبس أو مسبار محدب 3.5 ميغاهيرتز. أجري الفحص عن طريق مسح البطن لكل النساء الحوامل، وتم قياس حجم السائل الامنيوني باستخدام طريقة قياس أكبر عمق أو جيب.

خلصت الدراسة إلى أن معظم النساء الحوامل لهن كمية سائل طبيعية بنسبة (94%) وبقية النساء لهن كمية سائل غير طبيعية بنسبة)، (6%) وقد كانت عبارة عن زيادة في حجم السائل الامنيوني أوصت الدراسة بضرورة قياس حجم السائل الامنيوني حول الجنين بواسطة الموجات فوق الصوتية أثناء فترة الحمل.

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Introduction

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 Charleigh et al, 2004).

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 them other, 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).

1.2 Problems of study

1. Assessment of abnormal amount of AF is important for normal fetal development of and growth. Too little or too much AF is associated with different conditions and places the fetus is risk for prenatal complications.
2. Delay of pregnant woman to came to hospital.
3. Most of sonographer not measure A F V .
4. Little literature about the measure AFV was found to the best of the researcher knowledge`

1.3 Objectives

1.3.1 General Objective

Evaluation of Normal Amniotic Fluid Volume in second & third Trimester Using Ultrasonography for Sudanese women

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

Chapter Two

Literature Review

Chapter Two

Literature Review

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 (flattend 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 Importans 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 semi quantitative assessment have been proposed (Chamberlain PF, et al 2003).

2.1.3 Physiology of amniotic fluid

2.1.3.1Amniotic 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 trans abdominally. And 9 weeks trans vaginally. By term, a fetus produces on average from 500to 700 ml/day with a slight decline in hourly fetal urine production after 40 weeks' gestation (Peter, 2007).

2.1.3.2 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 it 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 enter absorption 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 collogues 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/ intravenous 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).

2.1.3.3 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 only5–10 ml/day in the third trimester. After 38 weeks, fluid volume declines by approximately125 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. (Carol M.Rumack et al, 2005).

2.1.3.4 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 (Canningham, 2005).

2.1.4 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.

2.1.4.1 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).

2.1.4.2 Quantitative Assessment

2.1.4.2 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)
b) < I cm (Chamberlain .2003)
c) <2cm (Manning .1990)
d) < 3 cm (Halperin.1985)

2.1.4.2.2 Amniotic fluid index Technique

Divided the uterus in to four quadrants using the lineanigra as the vertical axis the umbilicus as the horizontal axis The pocket with largest vertical dimension is measured in each quadrant. Sum of all four measurements = AFI Figure: (3.3): four pocket Measurement of AFI. (Trish et al, 2004)

Values

a) < 5 cm =very low (oligohydramnios)
b) 5.1 – 8cm = low
c) 8.1 – 2.5 cm = normal.
d) > 25 cm = polyhdramnios.

2.1.4.3 Controversies in cut off criteria for Oligohydramnios (Trish, et al, 2004)

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 AF 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 singlemeasurement.

Disadvantages

a) Wide intra observer & inter observer error (Rumack et al, 2005).
b) AFI < 5cm - interobserver error = 2cm.
c) AFI > 20 cm - interobserver error = 5cm.

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.

2.1.5 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 a crania-anencephaly sequence (AAS) secondary to exfoliation (sloughing) of fetal brain tissue in the amniotic fluid and related bleeding (Trish et al, 2004).

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 an encephaly 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).

2.1.6 Pathology of amniotic fluid

2.1.6.1 Oligohydramnios

Oligohydramnios is defined as decreased amount of amniotic fluid. An hydramnios 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 are no detectable amniotic fluid pockets on ultrasound examination.

There is 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 than2cm with the Phelan method,

oligohydramnios is indicated if the sum of the four measured pocked of amniotic is 8 cm or less (Rosenkrantz, 2012).

2.1.6.2 Visual ultrasound features of oligohydramnios include

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

2.1.6.3 Most Common Causes of Oligohydramnios

Premature rupture of membranes Chronic fetal death post term 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),

2.1.6.4 Premature rupture of membrane (PROM)

PROM is defined as rupture of amniocherionic membrane prior to the onset of labor. Ruptured membranes are signified at any time to during pregnancy by either a sudden gush ora steady trickle of clear fluid from vagina, in term pregnancy, labor usually ensues within 24hours 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),

2.1.6.5 Fetal death

Second and third trimester fetal demise can be attributed to many different single causes, or toa 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).

2.1.6.6 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).

2.1.6.7 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 circumferences 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 are:

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 al, 2005).

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 (Rosenkrantz, 2012)

Bilateral uretropelvic obstruction

Uretropelvic 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. UPJ obstruction is associated with variable degree of oligohydramnios and a variable prognosis depending on the severity and duration of renal obstruction (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 (EberhardMerz,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 revolved, 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 serve 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 a boring spontaneously in the first trimester. (Rosenkrantz, 2012)

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

It is unequal shunting of blood from one twin to other through placental anastomotic vascular channels, in TTS, 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 disordance and amniotic fluid volume disordance (oligohydramnios associated with the donor fetus and polyhydramnios associated with the recipient fetus (TrishChudleigh, et.al, 2004).

2.1.6.8 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).

Type of polyhydramnios

- **Mild polyhydramnios (80%)**

  A pocket of amniotic fluid measuring 8-11 cm or four pocket measuring 25 – 30 cm.

- **Moderate polyhdramnios**

  A pocket of amniotic fluid measuring 12-15 cm or four pocket measuring 30.1 – 35 cm

- **Serve polyhydromnios**

  A pocket of amniotic fluid measuring 16 cm or more or four pocket measuring <35.1cm (Rumack et al, 2005).

2.1.6.9 Most Common Causes of Polyhydramnios

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

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

- Insulin dependent diabetes (IDDM).
- Non- insulin dependent diabetes (NIDDM).
- Gestational diabetes (GDM).
- Impaired glucose tolerance (IGT)

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 (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 vasopression 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 than100 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 fetal is. 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 hemi diaphragm. 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) (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 (TrishChudleigh 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 fetal is 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).

2.2previous studies

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

Ms. Hala ElAwni Mahdi ElAwnitm 2015 Sudan University of Science and Technology was study the normal volume of amniotic fluid among Sudanese population in 2^{nd} and 3^{rd} trimester by using ultrasound 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 reaches 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 The study was carried out to assess the amniotic fluid volume in pregnant women in second and third trimester.

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

Mr. Mohammed Alhaj Ali Abdalgader Ali 2016.Sudan University of Science and Technology. His study was carried out to assess the amniotic fluid volume in pregnant women in second and third trimester The study was conducted on 50 pregnant women their second and third trimester over a period from September 2016 to November 2016 in universal Ribat Hospital, depended on the international study protocol in obstetrical scanning. All pregnant women were subjected to be examined by Ultrasound scanning using simense scanner with 3.5MHz convex probe Trans abdominal scanning were performed for all pregnant women and measure the amniotic fluid volume by using, 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 (56%) and few others pregnant women have an abnormal amniotic fluid (44%).

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

Chapter Three

Materials and Methods

Chapter Three

Materials and Methods

3.1 Materials

3.1.1 Machine used

SIMENS G00S, Germany, 2004, model 7674532 transabd. Convex probe 3.5MHz. Mindray model DC -3, transabdominal Convex probe 3.5MH

3.1.2 Population

The study population was composed of 50 pregnant women in their second and third trimester presented to the ultrasound section in universal Alribat hospital and Omer sawi complex, during the period from first of September to thirty of December 2018.

3.1.3 Included criteria

The patients 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 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 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. The four pocket measurements are then added to calculate the AFI. Normal AFI values ranges from 8-25 cm.

3.2.2 Data analysis

The data were analyzed using SPSS statistics.

3.2.3 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

4.1 Results

Table 4.1: Frequency distribution to maternal age

Age	Frequency	Percentage
<20	3	6 %
20 – 29	32	64 %
30 – 40	15	30 %

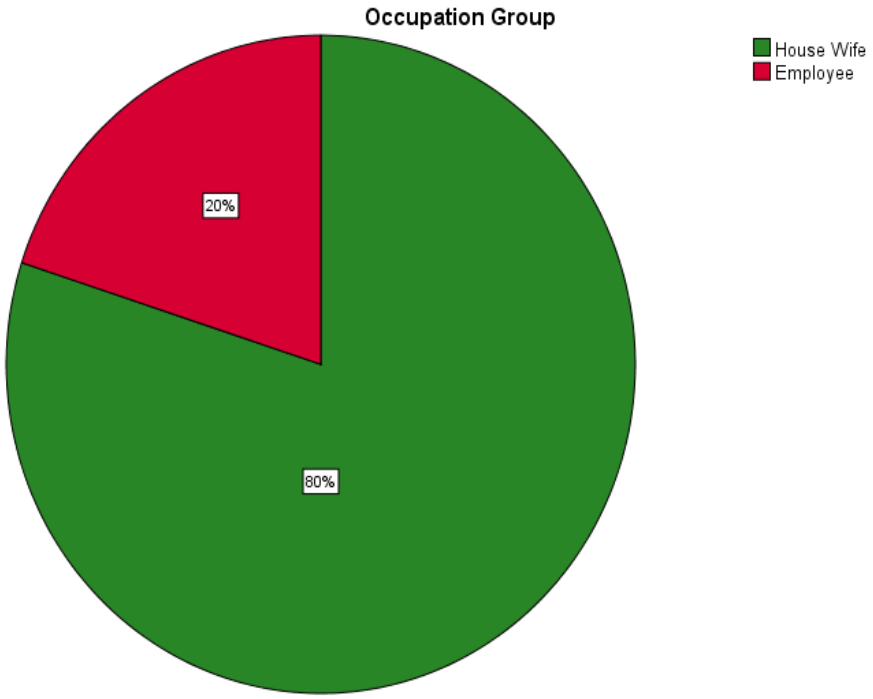


Figure 4.1: Frequency distribution according to occupation Group

Table 4.2: Frequency distribution of maternal occupation group

Occupation	Frequency	Percentage
House Wife	40	80 %
Employee	10	20 %

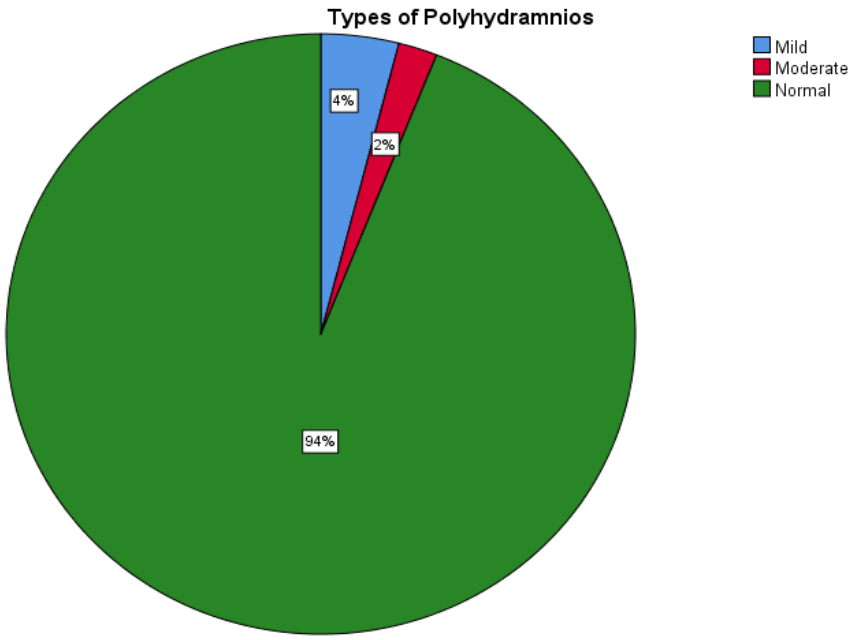


Figure 4.2: distribution of AFI (Normal, and Polyhydramnios)

Table 4.3: Frequency Distribution of Amniotic Fluid volume

AFI	Frequency	Percentage
Normal	47	94 %
Increased	3	6 %
Decreased	0	0

Table 4.4: Frequency distribution of types of polyhydramnios

Type of Polyhydramnios	Frequency	Percentage
Mild	**2**	**4 %**
Moderate	**1**	**2 %**

Chapter five

Discussion, conclusion and recommendation

Chapter five

Discussion, conclusion and recommendation

5.1 Discussion

The main objective of this study was to evaluate the AFV by U/S in pregnant women in second and third trimester. Total of 50 pregnant women were studied from first of September to December 2018, investigated in ALribat universal hospital& Omer sawi complex in Khartoum state. amniotic fluid indices were measure by routine ultrasound scan. The range of maternal age from <20 to 40 years with gestational age from 22 – 38 weeks. Data analysis was performed with SPSS.

table (4.1) represented the age groups of pregnant women under study, out of 50 cases in this study 3 cases (6%) their ages were less than 20 years, 32 cases (64%) their age group between (20-29) years, 15 cases (30%) their age group between (30-40) years.

Table (4.2), showed that 40 pregnant women (80%) were house wifies, 10 pregnant women (20%) were employee cases as in Figure (4.1).

Figure (4.2) showed that out of 50 pregnant women in this study 47 pregnant women had normal AFV (94%), 3 pregnant (6 %) had increased in AFV (6%), no pregnant women had decreased in amniotic fluid (0%) as indicated in Table (4.3).

as presented in table (4.4), 3 pregnant were found to had polyhydramnios, 2 had mild polyhydramnios (4%), 1 had moderate polyhydramnios (2%).

the highest percent was (94%) of group under study found to be Normal in (AFV) which showed good agreement with Mr. Mohamed Elhaj (Sudan University of Science and technology , 2016) study , his study found that most of the pregnant women had normal amniotic fluid (56%) and also Ms.

Hala ElAwni Mahdi ElAwni (2015) Sudan University of Science and technology, her study found that most of the pregnant women had normal amniotic fluid (88.9%) also in polyhydromnios (6%), Mr. Mohamed Elhaj (42%), and Ms. Hala ElAwni Mahdi ElAwnitm (4.4%), disagreement in oligohydramnios (0 %) in this study, (2 %) Mr. Mohamed Elhaj, and (6.7 %) in Ms. Hala Elawni Mahdi (6.7%) study.

5.2 Conclusion

This study showed that most pregnant women under study had normal amniotic fluid volume.

and abnormal amniotic fluid volume. The study showed that the normal AFV was 94%, and abnormal was (6%) the increase is 6% and 0% is decrease AFV is. In abnormal amniotic fluid Polyhydramnios occurs in 6% and oligohydramnios are occurring in 0% of 50 pregnant women. The study shows that most causes of Polyhydramnios in diabetic mother Mild and moderate types of Polyhydramnios are common types and severe form is the common type of oligohydramnios.

5.3 Recommendation

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

- Amniotic fluid must be assessed by ultrasound method and not depend only on the observation of the sonographer to prevent missing amniotic fluid volume abnormality.
- A single deepest pocket method should at least be used, as it is simpler to perform and less time consuming.
- Further studies are recommended for providing more accurate
- estimates of the normal range of amniotic fluid index in Sudanese pregnant women.

Appendices

Appendix (A)

Sudan University of Science and Technology College of Graduate Studies M.sc, Program Data collection sheet Evaluation of Normal Amniotic Fluid Volume in second & third Trimester Using Ultrasonography for Sudanese women

- Age

  <20 ( )

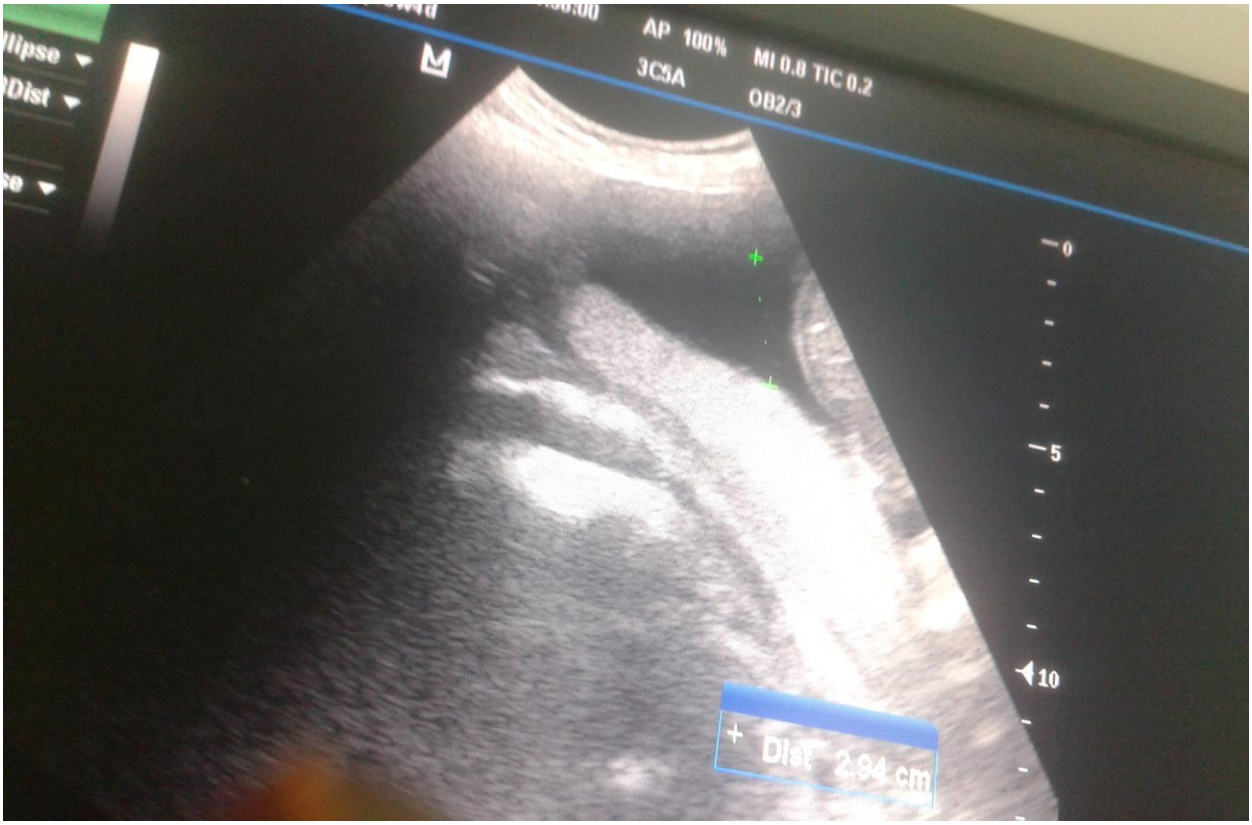
  20-30( )

  31-40( )
- Occupation: Employee ( ) House wife ( ) others ( )
- GA: weeks( )
- The AF is:

  Normal ( ) Increase ( ) Decrease ( )
- The Measurement of AFV

  AFI ( ) Cm.
- **Type of poly Hydromnos**
  1. Mild ( )
  2. Moderate ( )
  3. Severe ( )
- Type of oligohydromnios
  1. Mild ( )
  2. Moderate ( )
  3. Severe ( )

Appendix (B)



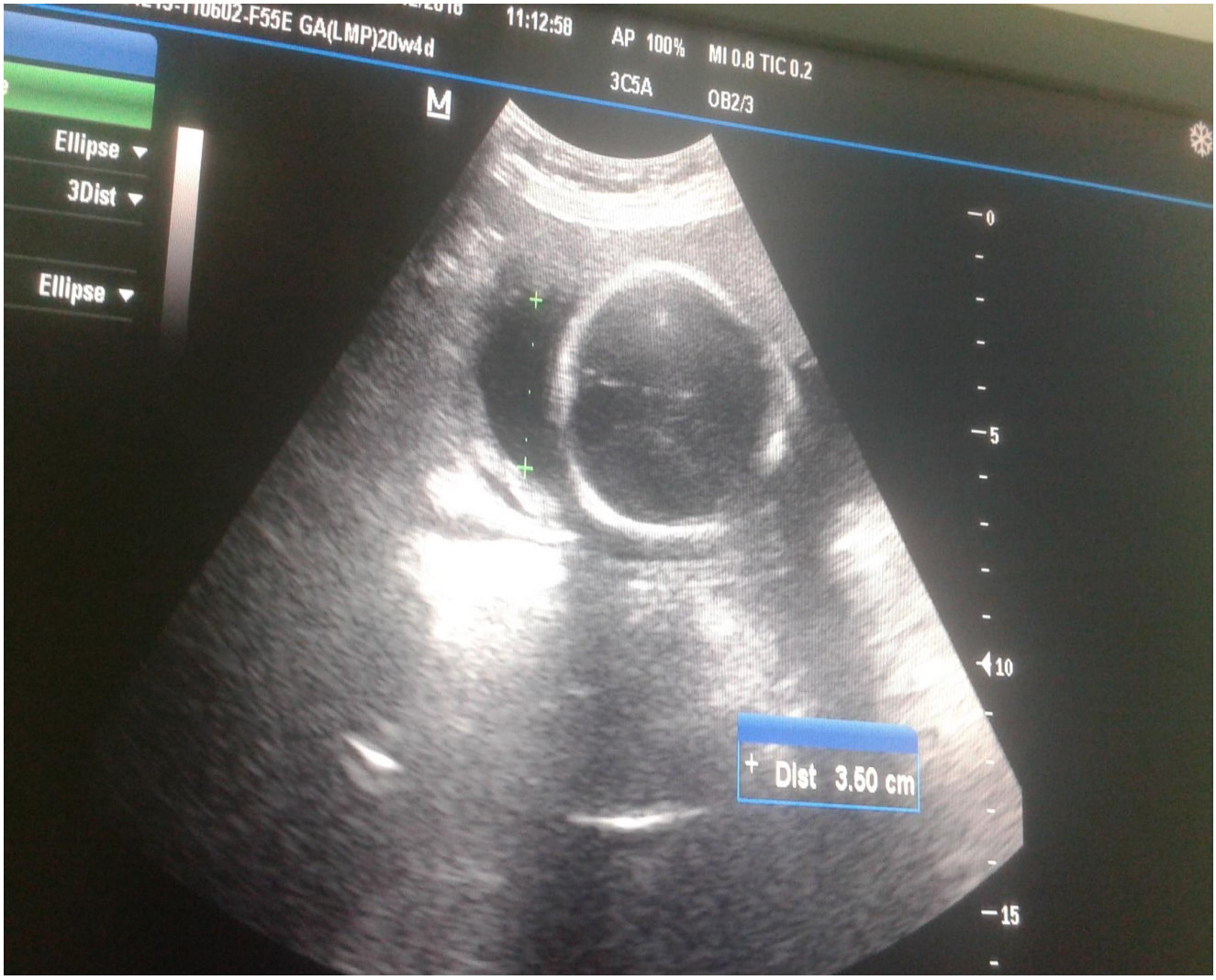
(A) Pregnant ladies 23years old & 22week gestational age &SDP (2.94 cm)

(B)Pregnant ladies 34years old & 23week gestational age

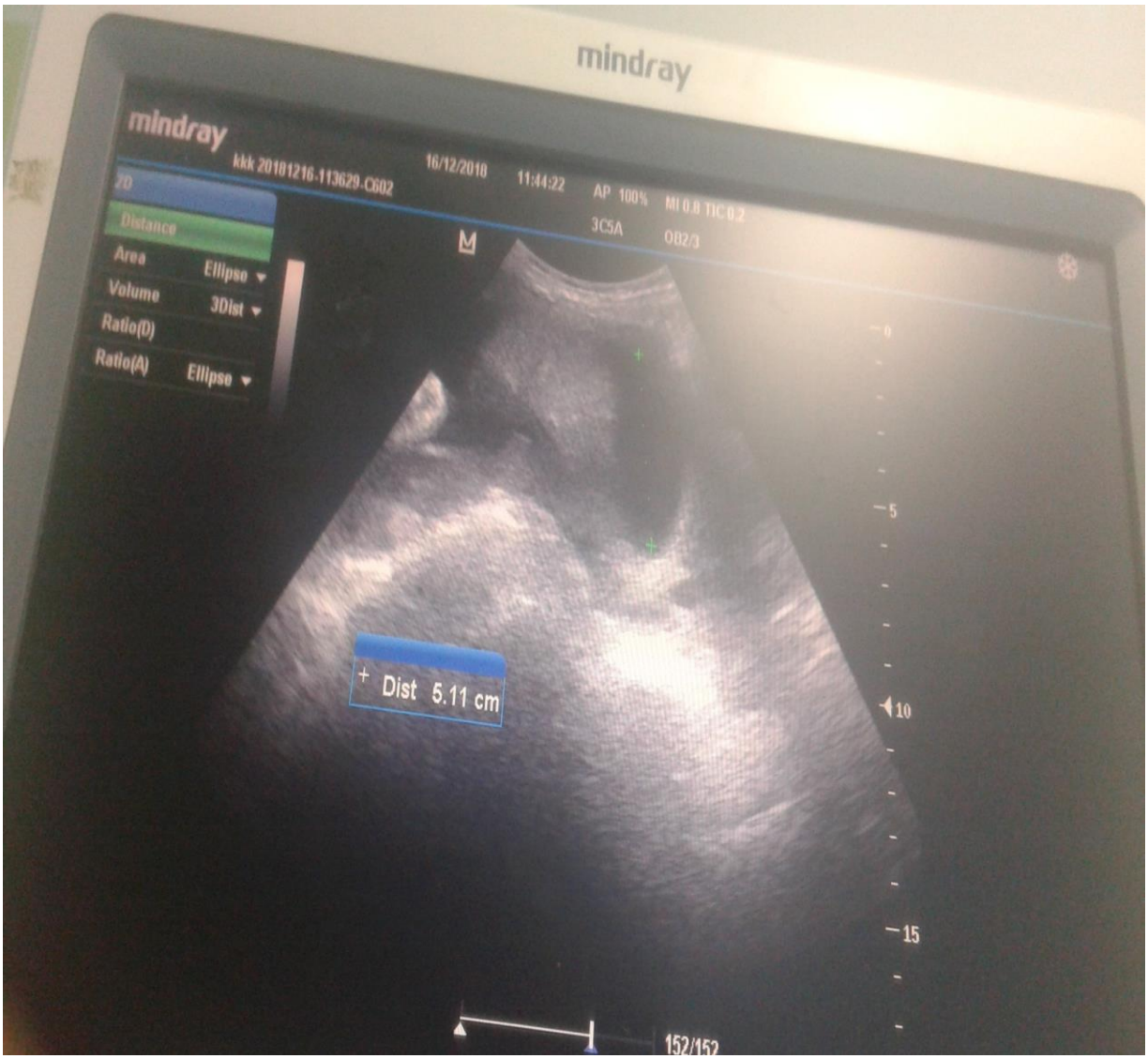
&SDP (3.58cm)

(C)Pregnant ladies 33years old & 22week gestational age &SDP(4.56cm).

(D)Pregnant ladies 30years old & 24week gestational age &SDP(6.55cm)



(E)Pregnant ladies 27years old & 23week gestational age &SDP (3.50cm)



(F)Pregnant ladies 33years old & 31week gestational age &SDP (5.11cm)

(G)Pregnant ladies 35years old & 34week gestational age &SDP(3.97cm)

(H)Pregnant ladies 28 years old & 34week gestational age &SDP(2.78cm)

(I) Pregnant ladies 29 years old & 35week gestational age &SDP(2.51cm

Abbreviations

AF	Amniotic fluid
AFI	Amniotic fluid index
GA	Gestational age
IUGR	Intrauterine growth restriction
PROM	Premature rupture of membranes
SDP	Single deepest pocket
US	Ultrasound
IVC	Inferior Vena Cava
AC	Abdominal circumference

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