

Sudan University Of Science And Technology

College Of Graduate Studies

**Study of Yolk Sac Abnormalities in the First
Trimester Using Ultrasonography**

دراسة تشوهات كيس الصفار في الثلث الاول من الحمل باستخدام
الموجات فوق الصوتية

(A Thesis Submitted For Partial Fulfillment Of The
Requirements Of M.Sc Degree In Medical Diagnostic
Ultrasound)

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Dedication

I dedicate this work to:

**My parents whom support me and sought to
blessed comfort and happiness, they gave
everything to push me in a way of success and
pray for me.**

My brother and sister whom we love.

**My colleagues and everyone who help me at any
time in my life.**

With my love and appreciation

Acknowledgement

I wish to thank my committee members who were more than generous with their expertise and precious time. A special thanks to **Dr. MUNA**, my committee chairman for his countless hours of reflecting, reading, encouraging, and most of all patience throughout the entire process.

I would like to acknowledge and thank my university division for allowing me to conduct my research and providing any assistance requested.

Abstract

This study was conducted in Khartoum state Sudan, in the ultrasound departments of khartoum north teaching hospital, Alskeikh Mohammed Ali Fadol and new omdurman hospital. The problem of the study was difficulty of sonographic detection of yolk sac abnormalities, and lack of interest for evaluation by sonographer and sonologist. The aim of the study was to estimate the role of ultrasound in the diagnosis of yolk sac abnormalities, the complication associated with it, and the usefulness in prediction of pregnancy outcome. This was observational analytical study carried out during the period from January to July 2014. The data was collected from 100 pregnant women during first trimester of pregnancy, classified and analyzed by using SPSS (statistical package for social science). The analysis of the results showed that all yolk sac abnormalities were diagnosed by ultrasound with absence yolk sac (46%), large yolk sac (29%), irregular yolk sac, (6%) Small yolk sac (5%), calcified yolk sac (13%), echogenic yolk sac (1%), and there was no patients with persistent yolk sac. The complications were bighted ovum (46%) and missed miscarriage (37%). Which affect middle aged women (20 – 30 years) (52%), multigravid (60%), paraII (31%), with no history of chronic disease (95%), and can be detected by transabdominal (41%) or endovaginal probe (59%) with transvaginal technique was more accurate. The most yolk sac abnormalities associated with complication were absence, large, and irregular yolk sac which predict poor pregnancy outcome. Other Small, calcified, echogenic, and persistent yolk sac abnormalities cannot predict poor pregnancy outcome and most commonly associated with normal pregnancy. The study recommended that all pregnant women during first trimester of pregnancy should do obstetric ultrasound and yolk sac should be evaluated carefully for any abnormalities.

مستخلص الدراسة

أجريت هذه الدراسة في والية الخرطوم- السودان، في أقسام الموجات فوق الصوتية بمستشفى الخرطوم بحري، ومستشفى الشيخ محمد علي فضل ومستشفى أم درمان الجديد. مشكلة الدراسة هي صعوبة الكشف عن تشوهات الكيس المحي بالموجات فوق الصوتية وعدم اهتمام تقنيي وخصائيي الموجات فوق الصوتية بتقييم تشوهات الكيس المحي. هدفت الدراسة لتقييم دور الموجات فوق الصوتية في تشخيص حالات حويصلة المح الغير طبيعية، المضاعفات المرتبطة بها، والسفاده منها في التنبؤ بنتيجة الحمل. وهي دراسة رصدية تحليلية اجريت في الفترة من ديسمبر إلى مارس 2019 جمعت البيانات من 211 امرأة في الفترة الولي من الحمل، صنفت وحلت بإستعمال التحليل الحصائي الرزمة الحصائية لعلم أجمع. ووضحت النتائج بأن كل حالات حويصلة المح الغير طبيعية شخصت بالموجات فوق الصوتية وكان غياب الكيس المحي 24%(حويصلة مح كبيرة) 12%(حويصلة مح شاذة) 4%(حويصلة مح صغيرة) 5%(تكلس حويصلة المح) 21%(حويصلة مح بصدى داخلي) 2%(ولم تكن هناك حالات بحويصلة المح الدائمة. المضاعفات المرتبطة بتشوهات الكيس المحي كانت البويضة الفارغة) 24% (و أجهاض المفقد 13% (والتي تؤثر على النساء في منتصف العمر التي كانت لهم أكثر من ثلاثة فترات حمل سابقة 41%(وكانت نتائج الحمل طبيعية لمرتين) 12%(وليس لهم تاريخ من المرض المزمن) 25%(وتم الكشف بالموجات فوق الصوتية عن طريق جدار البطن) 22%(و عن طريق الموجات فوق الصوتية المهبلية) 52% مع ان الموجات فوق الصوتية المهبلية أكثر دقة.

أكثر حالات حويصلة المح الغير طبيعية التي إرتبطت بمضاعفات كانت غياب حويصلة المح، حويصلة مح كبيرة و حويصلة مح شاذة التي يمكن ان تستخدم في التنبؤ بنتيجة سيئه للحمل.

اما حويصلة المح الصغيرة ، حويصلة المح المنكسة ، حويصلة مح بصدى داخلي من حالات حويصلة المح الغير طبيعية ال تستطيع التوق ع بنتيجة حمل سي ئة ومرتبطة بالحمل الطبيعي.

أوصت الدراسة بأن كل النساء الحوامل أثناء الفترة الولي من الحمل يجب أن يخضعن لفحص موجات فوق صوتية للحمل وحويصلة المح يجب أن تقيم بعناية في الحالات غير الطبيعية.

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List of abbreviation

CD	Color Doppler Ultrasound
EVS	Endovaginal Sonography
G	Number of gravity
GA	Gestational Age
GS	Gestational Sac
LMP	Last Menstrual Period
MGSD	Mean Gestational Sac Diameter
MHZ	Megahertz
MSD	Mean Sac Diameter
MYSD	Mean Yolk Sac Diameter
P	Number of parity
PD	Power Doppler Ultrasound
SPSS	Statistical Package For Social Sciences
TAS	Transabdominal Sonography
TVS	Transvaginal Sonography
US	Ultrasound
YS	yolk sac
3D	Three Dimentional Ultrasound
4D	Four Dimentional Ultrasound

Chapter One

Chapter One

Introduction

1-1 Introduction:

Ultrasound is considered as high developed technology of sound properties during the last 20 years to demonstrate and diagnosis of variant diseases such as yolk sac abnormalities. Conventional 2D ultrasound imaging is the standard modality in most Obstetric and Gynecological applications however the addition of various Doppler technologies provides an excellent adjunctive tool for sonographic diagnosis in many Obstetric and Gynecological patients, the two commonly applied techniques are transabdominal (TAS) and endovaginal (EVS) sonography (Devin and Dean, 2005).

First trimester scanning is useful to identify abnormalities in the early development of a pregnancy. Gestational sac is the earliest sonographic finding in pregnancy, the first structure in the gestational sac to be sonographically visualized is the yolk sac (Devin and Dean, 2005).

The yolk sac is the initial source of exchange between the mother and the embryo. It provides nutritive, metabolic, endocrine, immunological and hematopoietic functions (Kurjak and Chervenak, 2003).

The yolk sac appears as a circular transonic mass within the gestation sac and can first be identified transvaginally at about 35 days, when it measures 3–4mm in diameter. At This stage it is significantly larger than the embryo. It is a prominent landmark to search for within the early gestation sac and, because of its close association with the embryo at this stage, identifying it will automatically lead to the embryo (Chudleigh and Thilaganathan, 2004).

Using EVS, the yolk sac should always be visualized when the mean

gestational sac diameter (MGSD) is 8 mm or greater. While using the transabdominal technique the yolk sac may not be seen before the 6th week of gestation. However, it will be demonstrated by 7 weeks GA when the MSD is 20 mm. The yolk sac diameter increases steadily (0.1 mm per day) until 10 Weeks GA to a maximum of 5 to 6 mm (Devin and Dean, 2005).

After 10 weeks LMP, the yolk sac is more difficult to visualize as it is compressed by the expanding amnion and amniotic cavity (Devin and Dean, 2005).

After about 8 weeks LMP, the yolk stalk (sometimes labeled the vitelline duct) may be seen in the gestational sac as a separate cord-like structure connecting with the yolk sac. The thickness of the yolk stalk is similar to the thickness of the wall of the yolk sac. The yolk stalk appears much thinner than the umbilical cord and much thicker than the amnion (Devin and Dean, 2005).

The demonstration of the yolk sac confirms that the sac represents an early intrauterine pregnancy, as opposed to a pseudosac appearance with an ectopic pregnancy(Kurjak and Chervenak, 2003).

Correlation between yolk sac morphology and the outcome of pregnancy is not clear. Some studies suggest that the absence of the yolk sac before 8 weeks indicates an abnormal pregnancy even when the embryo is alive. Miscarriage is apparently common in this situation. Furthermore, in cases of missed abortion with a visible embryo, the yolk sac tends to be larger and its wall is thinner than in normal pregnancies. However, other studies have not showed any significant correlation between size and shape of the yolk sac and pregnancy outcome (Chudleigh and Thilaganathan, 2004).

This study is focus on the role of ultrasound in the diagnosis of yolk sac abnormalities and complication associated with it, and to find out whether abnormalities can be used to predict the pregnancy outcome for care of pregnant women.

1-2 Problem of the study:

Ultrasound has a great role in diagnosis of yolk sac abnormalities in first trimester , ultrasound is best procedure to detect complications associated with yolk sac abnormalities , most yolk sac abnormalities can be used in prediction of pregnancy outcome , difficulty of sonographic detection of yolk sac abnormalities, and lack of interest for evaluation by sonographer and sonologist.

1-3 Objectives:

1-3-1 General Objective:

To estimate the role of ultrasound in diagnosis of yolk sac abnormalities in first trimester of pregnancy.

1-3-2 Specific Objectives:

- To detect the yolk sac abnormalities.
- To detect complications associated with yolk sac abnormalities.
- To determine the relationship between the frequency of occurrence of yolk sac abnormalities and pregnancy outcome.

1-4 Overview of the study:

This study is concerned with the normal measures of the prostate gland by using trans-abdominal ultrasound, accordingly it falls into five chapters: chapter one is an introduction which includes: brief anatomy, the problem, the objectives of study and the overview. Chapter two includes: detailed background about the anatomy, and sonogram of the gland as well as the literature review. Chapter three deals with the materials and method used to conduct this study. Chapter four illustrates the results using figures and tables. And finally chapter five presents discussion, conclusion, and recommendations of the study followed by references and appendices.

Chapter Two

Chapter Two

Literature review

2-1 anatomy:

It is the first element seen in the gestational sac during pregnancy, usually at 3 days gestation. It is a critical landmark, identifying a true gestation sac. It is reliably seen early in human pregnancy using ultrasound .

The yolk sac is one of the three embryonic cavities (chorion, amnion and yolk sac), that appears as of day 8 of human development as a transient primary yolk sac, and is situated on the ventral aspect of the embryo (Wikipedia , 2018).

By the 9th day, a crop of flattened cells develops inside the cytotrophoblasts. These cells either originate from the cytotrophoblasts or from the hypoblast . Hypoblast cells are considered the developmental origin of the human yolk sac, toward the end of the second week of gestation, the lower half of the primary yolk sac is pinched off to form the definitive yolk sac; Secondary yolk sac is much smaller than primary yolk sac.

A second wave of hypoblast endoderm cells (yolk sac endoderm) form the inner lining of the definitive yolk sac. Thus, the definitive yolk sac structure consists of a double-layered extraembryonic membrane with hypoblast-derived endoderm on the inside and mesoderm on the outside, the combination of endoderm and mesoderm layers is called splanchnopleure and appears in both the yolk sac and the allantois, The endodermal tissue supplies functioning epithelial cells, while the mesoderm generates the essential blood supply to and from this epithelium. Additionally, the outer mesodermal layer of the yolk sac serves as a key location of hematopoiesis . in the developing embryo. The yolk sac cavity is filled with the vitelline fluid. In humans, the yolk sac normally disappears before birth. Nutrients are

absorbed from the yolk-sac through a complex capillary plexus and vitelline veins (the vitelline circulation) and are conveyed to the embryo. The allantois arises as a tubular diverticulum of the posterior part of the yolk sac. A constriction in the yolk sac encloses a small part of yolk sac within the embryo, forming the primitive digestive tube. Connection with the embryonic digestive system is gradually reduced to a small tube called the vitelline duct (sometimes called the umbilical vesicle) .

After about 8 weeks LMP, the yolk stalk (sometimes labeled the vitelline duct) may be seen in the gestational sac as a separate cord-like structure connecting with the yolk sac. The thickness of the yolk stalk is similar to the thickness of the wall of the yolk sac. The yolk stalk appears much thinner than the umbilical cord and much thicker than the amnion (Devin and Dean, 2005).

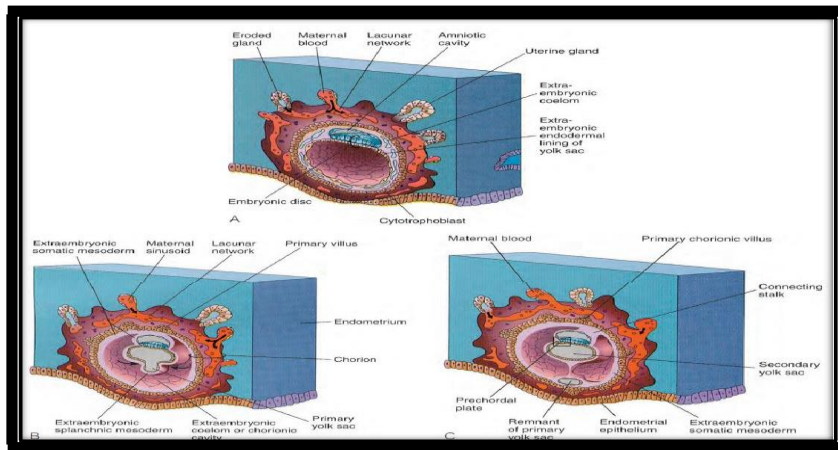


Figure (2.1): Formation of secondary yolk sac. A, Approximately 26 days: formation of cavities within extraembryonic mesoderm. These cavities will enlarge to form extraembryonic coelom. B, about 27 days, and C, 28 days: formation of secondary yolk sac with extrusion of primary yolk sac. Extraembryonic coelom will become chorionic cavity (Rumack, 2011).

Using EVS, the yolk sac should always be visualized when the mean gestational sac diameter (MGSD) is 8 mm or greater. While using the transabdominal technique the yolk sac may not be seen before the 6th week of gestation. However, it will be demonstrated by 7 weeks GA when the MSD is 20 mm. The yolk sac diameter increases steadily (0.1 mm per day) until 10 Weeks GA to a maximum of 5 to 6 mm (Kurjak and Chervenak, 2003).

At 32 days the yolk sac is large, by 10 weeks the yolk sac has shrunk to a pear-shaped remnant about 5 mm in diameter and is connected to the midgut by a narrow yolk stalk, by 20 weeks the yolk sac is very small; thereafter it is usually not visible, The yolk sac is recognizable in ultrasound examinations until the end of the first trimester .

2-2 Physiology of yolk sac:

The yolk sac is the initial source of exchange between the mother and the embryo. It provides nutritive, metabolic, endocrine, immunological and hematopoietic functions

(Kurjak and Chervenak, 2003).

Transfer of nutrients to the embryo during the second and third weeks when the utero-placental circulation is being established , Allantois develops from its posterior during 3rd week , Blood development first occurs in the well-vascularized extra-embryonic mesoderm covering the wall of the yolk sac beginning in the third week and continues to form there until hemopoietic activity begins in the liver during the sixth week , Origin of the epithelial lining of the gastro-intestinal and respiratory tracts , Production of albumin, alpha fetoprotein and other proteins during the embryonic period , The

presence of the amnion and yolk sac enables early recognition and measurement of the embryo (Kurjak and Chervenak, 2003) .

2-3 pathology of yolk sac:

2-3-1 Absence of the Yolk Sac :

The yolk sac performs important functions for embryonic development during organogenesis. On transvaginal sonography, absence of the yolk sac in the presence of an embryo is always abnormal and in general is associated with subsequent embryonic death (Sinan et al., 2012).

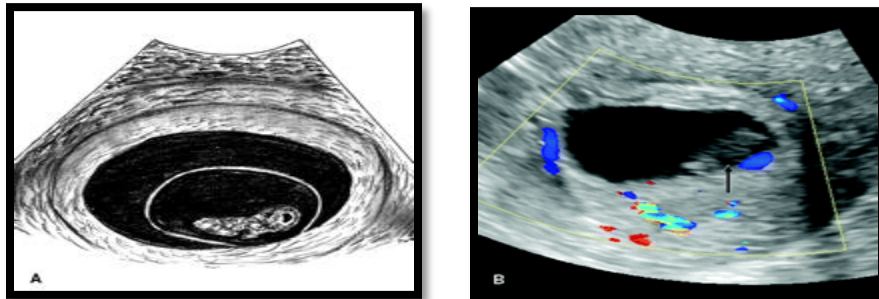


Figure (2.2): Absence of a yolk sac. **A**, Diagram shows absence of a yolk sac within the gestational sac. **B**, Transvaginal sonography at 6 weeks 6 days shows embryonic death (arrow) with absence of a yolk sac in the extraembryonic area (Sinan et al., 2012).

2-3-2 Large Yolk Sac:

Most authors accept either 5 or 6 mm as the upper limit for the size of a normal yolk sac in pregnancies with a gestational age from the 5th to the 10th weeks. Generally, it has been suggested that an abnormally large yolk sac may indicate a poor obstetric outcome (spontaneous abortion) (Sinan et al., 2012).

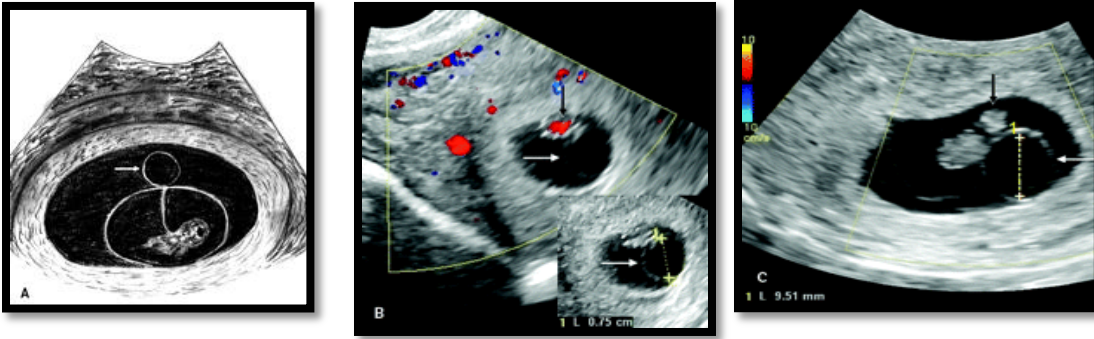


Figure (2.3): Large yolk sac. **A**, Diagram shows a large yolk sac (arrow) within the gestational sac. **B**. Transvaginal sonography at 7 weeks 1 day shows an embryo with cardiac activity (black arrow) and a large yolk sac (white arrows) with a mean diameter of 7.5 mm. **C**, On a follow-up examination 7 days later, no cardiac activity was identified, indicating embryonic death (black arrow), and the yolk sac (white arrow) had become larger (9.5 mm) (Sinan et al., 2012).

2-3-3 Small Yolk Sac :

It has been claimed that a very small yolk sac may be a normal finding during early periods of normal embryologic development. On the other hand, a much earlier published study, with certain limitations, suggests that a yolk sac diameter of 2 mm or less may be associated with an adverse outcome in pregnancies with a gestational age of 8 to 12 weeks (Sinan et al., 2012).

It is well known that the yolk sac size begins to decrease during the late weeks of the first trimester. This process is why gestational age should be taken into account when the size of the yolk sac is assessed (Sinan et al., 2012).

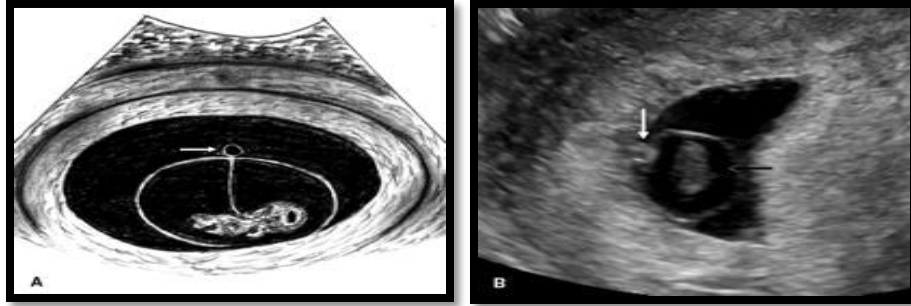


Figure (2.4): Small yolk sac. **A**, Diagram shows a small yolk sac (arrow) within the gestational sac. **B**, Transvaginal sonography at 7 weeks shows embryonic death (black arrow) and a small yolk sac (white arrow) with mean diameter of 1.9 mm (Sinan et al., 2012).

2-3-4 Calcified Yolk Sac :

A calcified yolk sac may appear as a shadowing echogenic mass in the absence of any other identifiable yolk sac. It has not been reported to be associated with a live embryo before the 12th week of gestation. In fact, a calcified yolk sac will only be seen with a dead embryo and may calcify within 36 hours after demise (Rumack, 2011).

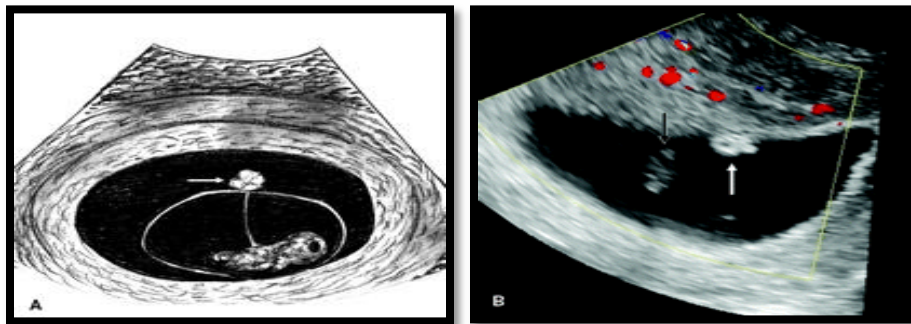


Figure (2.5): Calcified yolk sac. **A**, Diagram shows a calcified yolk sac (arrow) within the gestational sac. **B**, Transvaginal sonography at 6 weeks 5 days shows embryonic death (black arrow) and a calcified yolk sac (white arrow) (Sinan et al., 2012).

2-3-5 Echogenic Yolk Sac :

An echogenic (rather than anechoic) yolk sac is different from a calcified yolk sac in that echogenicity may represent various types of materials other than calcium. However, tissue harmonic imaging may be more useful for confirmation of this finding. To our knowledge, only one study reported that an echogenic yolk sac can be associated with fetal death or abnormalities (Sinan et al., 2012).



Figure (2.6): Echogenic yolk sac. **A**, Diagram shows an echogenic yolk sac (arrow) within the gestational sac. **B**, Transvaginal sonography at 6 weeks 6 days shows a live embryo (black arrow) and an echogenic yolk sac (white arrow) (Sinan Tan et al, 2012).

2-3-6 Irregular Yolk Sac Shape :

Yolk sacs with mainly wrinkled margins, indented walls, or both are usually identified as having an irregular shape. The clinical importance of an abnormal yolk sac shape is controversial and thus still under debate. There are a number of clinical studies that have declared that the persistence of an irregular yolk sac shape may be used to indicate an adverse gestational outcome. Just the same, a newly published study suggests that an irregular yolk sac shape is unrelated to an increased risk of spontaneous abortion (Sinan et al., 2012).

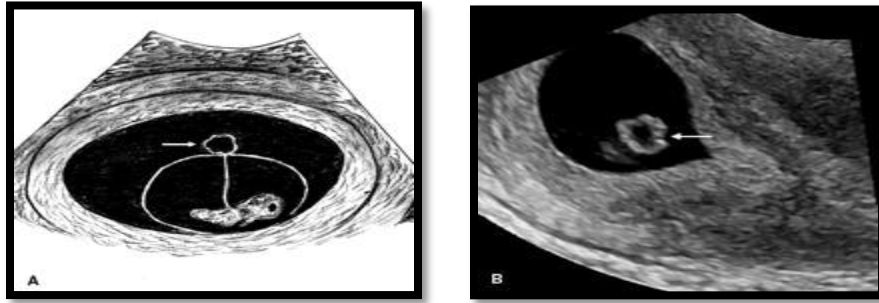


Figure (2-7): Irregular yolk sac. **A**, Diagram shows an irregular yolk sac (arrow) within the gestational sac. **B**, Transvaginal sonography of a live embryo at 6 weeks 6 days shows a yolk sac with an irregular shape (arrow) (Sinan et al., 2012).

2-3-7 Persistent Yolk Sac :

When the 10th or 11th week of gestation is completed, the yolk sac begins to shrink rapidly and eventually disappears. However, sometimes the yolk sac can persist between the amnion and the chorion even after 12 weeks' gestation. The persistent yolk sac usually stands close to the site where the umbilical cord enters the placenta. The clinical importance of a persistent yolk sac is unknown (Sinan et al., 2012).

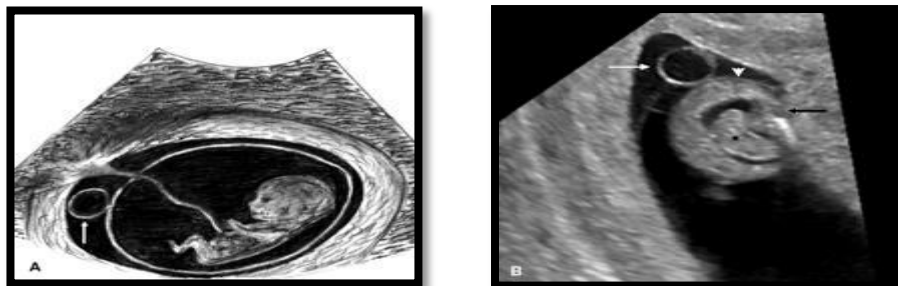


Figure (2.8): Persistent yolk sac. **A**, Diagram shows a persistent yolk sac (arrow) within the gestational sac. **B**, Transvaginal sonography at 12 weeks 3 days shows a live fetus with a persistent yolk sac (white arrow). The fetal head (black arrow), choroid plexus (star), and amniotic membrane (arrowhead) are indicated (Sinan et al., 2012).

2-4 Previous studies:

To assess value of yolk sac in predicting Pregnancy outcome during first trimester was observational study conducted by Nawal Rajani, Khuteta Sushila, Jain Deepika, Khuteta Rakesh, Meena Vinay al in Department of Obstetrics & Gynecology SMS Medical College Jaipur from August 2009 to October 2010 show 95 pregnant women of 20-30 years age group. Pregnancies with normal outcome (n=72). Pregnancies with abnormal outcome consisted of missed abortion (n=19) and blighted ovum (n=4). Four cases of missed abortion had irregular shaped YS. In anembryonic pregnancies YS was not seen. Abnormalities of the yolk sac size or shape, and absence can be used as poor predictive indicators of early pregnancy, even before fetal morphology can be studied sonographically (Nawal et al., 2012).

Abnormal sonographic appearances of the yolk sac which can be associated with adverse perinatal outcome were prospective observational study was approved by Sinan Tan et al in Ankara, Turkey from March 2011 to January 2012 show an abnormal yolk sac was found in 66 pregnancies of 6-9 weeks GA. 21.6% of them had abnormally appearing yolk sacs. An irregular yolk sac was observed in (78.8%), an enlarged yolk sac in (12.1%), and an echogenic yolk sac in (9.1%). In pregnancies with enlarged yolk sacs a miscarriage occurred in 37.5% of cases. The pregnancies with a yolk sac diameter ≥ 5 mm had a significantly higher risk of miscarriage ($p = 0.005$). The risk of miscarriage was statistically similar between the pregnancies with regular and those with irregular yolk sacs ($p = 0.73$). Miscarriage

occurred in 3.8% of pregnancies with irregular yolk sacs and none of pregnancies with echogenic yolk sacs. Adverse prenatal outcomes were not associated with either irregular or echogenic yolk sacs (Sinan et al., 2012).

Are Abnormal Yolk Sac Characteristics Important Factors in Abortion Rates was a cohort study carried out by Sanam Moradan, Mohammad Forouzesfar. On Amir University Hospital, Semnan, Iran during May 2009 to May 2010 shows a total of 193 cases were evaluated. We excluded 2 cases. Among the remainin191 cases of 5-6.5weeks GA, 22 (11.51%) had abnormal yolk sacs of which spontaneous abortion occurred in 14 (63.63%) cases. In the control group, out of 169 (89.49%) cases, spontaneous abortion was noted in 6 (3.55%). There was a statistically significant difference in abortion rates between the two groups ($p=0.000$). It is obvious that abnormal yolk sac characteristics are associated with spontaneous abortion (Moradan and Forouzesfar , 2009).

Can detection of the yolk sac in the first trimester be used to predict the outcome of pregnancy was prospective Study done by Alfred B Kurtz et al on Philadelphia, From February to June 1987 shows in the normal pregnancy group, the yolk sac was visualized in the majority of patients. By the abdominal approach, it was identified in 140 of the 163 patients (86%) (MSD range 10 to77 mm). By the transvaginal approach, the yolk sac was seen in 157 of the 163 patients (96%) (MSD range 8 to 69 mm). In the abnormal pregnancy group, the yolk sac was identified less often. By the abdominal approach, the yolk sac was seen in 19 of the 49 patients (39%) (MSD 16 to 52 mm). By the transvaginal approach, the yolk sac was identified in 31 of the 49 patients (63%) (MSD range 11 to 53 mm). The

study shows that detection of abnormal yolk sac cannot predict the pregnancy outcome (Kurtz et al., 2002).

Irregular Yolk Sac Shape was prospective Study done by Sinan Tan et al on Ankara, Turkey between May 2009 and February 2010 show 183 healthy pregnant women with mean age of 26.0 ± 5 years with gestational ages of 6 to 8 weeks. Most of the embryos had a yolk sac with a regular shape (152 of 183 [83%]), whereas the remaining embryos had a yolk sac with an irregular shape (31 of 183 [17%]). Although there was a trend toward a lower rate of irregular yolk sacs with advancing gestational age, the difference was not statistically significant ($P = 0.13$). Spontaneous abortion occurred in 6 of 183 pregnancies (3.3%): 1 of the 31 (3.2%) with an irregular yolk sac shape and 5 of the 152 (3.3%) with a regular yolk sac shape. The rates of spontaneous abortion were statistically similar for pregnancies with a regular yolk sac shape and those with an irregular shape ($P > 0.99$) (Sinan et al., 2012).

Chapter Three

Chapter Three

Materials and Method

3-1 Materials:

3-1-1 Subjects:

This was observational analytical study, deal with patients who came to department for obstetric ultrasound investigation . This study was conducted in duration from march – to july 2019. The population of this study was patients whom referred for obstetric Ultrasound scans . The sample size of this study was consisted of 100 cases .

3-1-2 Machines used:

Ultrasound machines: Mindray DP50 made in china , KAIXIN 2600 made in china , Mindray DP10 made in china, all of which has major machine two probes, with full US department facilities, and coupling jell. Also we use a personal computer, Sony, Satellite, core I5, made in japan, 2012.

3-2 Method:

3-2-1 Study Design:

This was observational analytical study deals with patients who came to the department for obstetric ultrasound investigation.

3-2-2 Area of the Study:

1. Alseikh Mohammed Ali Fadol and new Omdurman hospital.
2. Khartoum north teaching hospital.

3-2-3 Duration of Study:

This study was carried out from January 2014 up to July 2014.

3-2-4 Study Population:

Patient who came to ultrasound department for obstetric ultrasound in their first trimester of pregnancy.

3-2-5 Sample:

One hundred ladies in first trimester in different hospitals and health centers ultrasound department in Khartoum state were selected randomly.

3-2-6 Study Variables:

Patient's age.

Number of gravity.

Number of parity.

3-2-7 Data Collection:

Data were collected with clinical data sheet designed for this study and ultrasound images collected for the study.

3-2-8 Data Analysis:

The data was analyzed using Statistical Packaged for Social Studies (SPSS) version 20. Using frequency tables and bar graphs to inter present the variables used in the data collected. Also a correlation tests and scatters plots to find out the definite relationships between the prostate volumes and the other variables under study.

3-2-9 Method and technique:

This was observational analytical study conducted on obstetric and gynecological department of different hospitals in Khartoum state done on 100 pregnant ladies with different age group selected randomly during the

first trimester of pregnancy using transabdominal and transvaginal probe to visualize abnormal changes in mean yolk sac diameter, yolk sac shape and appearance and associated pregnancy outcome.

For transabdominal technique the patients were examined in supine position through full urinary bladder, and applying adequate amount of gel, transducer (3 to 5 MHZ) was placed in contact with the skin above to the symphysis pubis, and longitudinal and transverse planes were obtained (Devin Dean, 2005).

With transvaginal probe (5 to 10 MHZ) patients should empty her bladder and lies in supine with her buttock on the tip of the table, legs flexed on the thigh and abducted, small amount of gel was applied to the tip of the transducer, transducer is covered by condom, or surgical gloves, small amount of gel was applied then probe was inserted into vagina and sagittal and coronal planes were obtained (Devin Dean, 2005).

The yolk sac with wrinkled margins, indented walls, or both was defined as having an irregular shape. If the internal structure of a yolk sac had echogenicity rather than being totally anechoic, it was described as an echogenic yolk sac. Measurement done from inner to inner wall of the yolk sac for large yolk sac ≥ 6 mm and small yolk sac ≤ 2 mm. shadowing echogenic yolk sac is identified as calcified yolk sac. If no yolk sac was identified after careful evaluation of gestational sac, it was described as absence yolk sac. Any complication associated with yolk sac abnormalities were evaluated and documented.

3-2-10 Data Storage:

Data was stored in personal computer, and patient data sheet.

3-2-11 Ethical Consideration:

The study candidate at the patients who were already sent to the ultrasound department and selected randomly, No patient identification or individual patient details will be published, and patient will be consented before doing transvaginal sonography.

Chapter Four

Chapter Four

Results

4-1 Results:

Table (4.1): Distribution of patients with yolk sac abnormalities according to the age.

patients age	Frequency	Percent (%)
<20	7	7
20 – 30	52	52
30 – 40	38	38
>40	3	3
Total	100	100

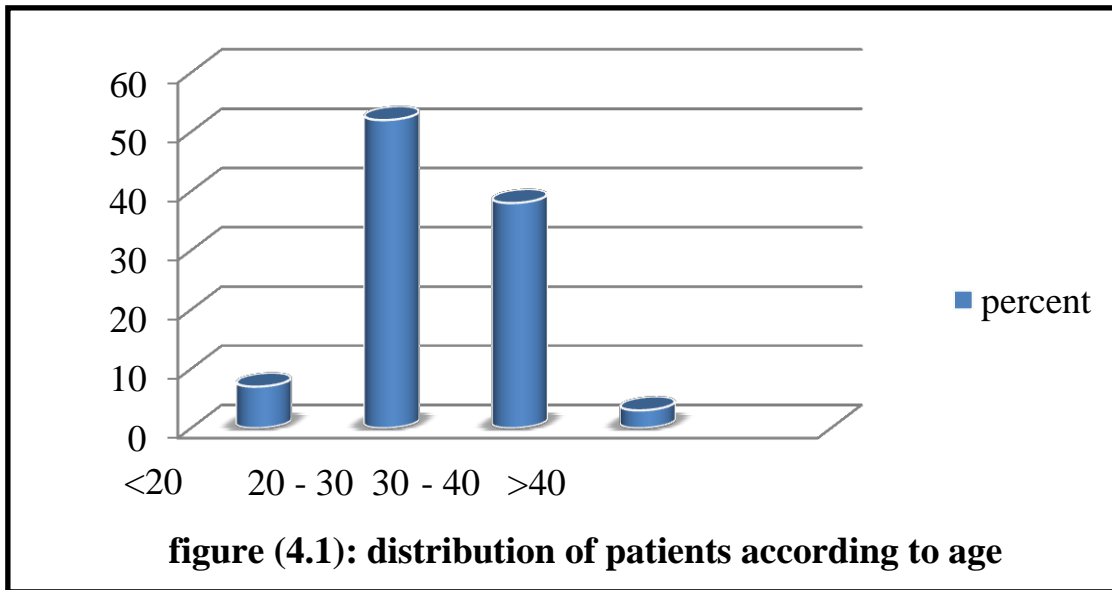


Table (4.2): Distribution of patients with yolk sac abnormalities according to gravity.

gravity	frequency	Percent (%)
GI	12	12
GII	28	28
multi gravid	60	60
Total	100	100

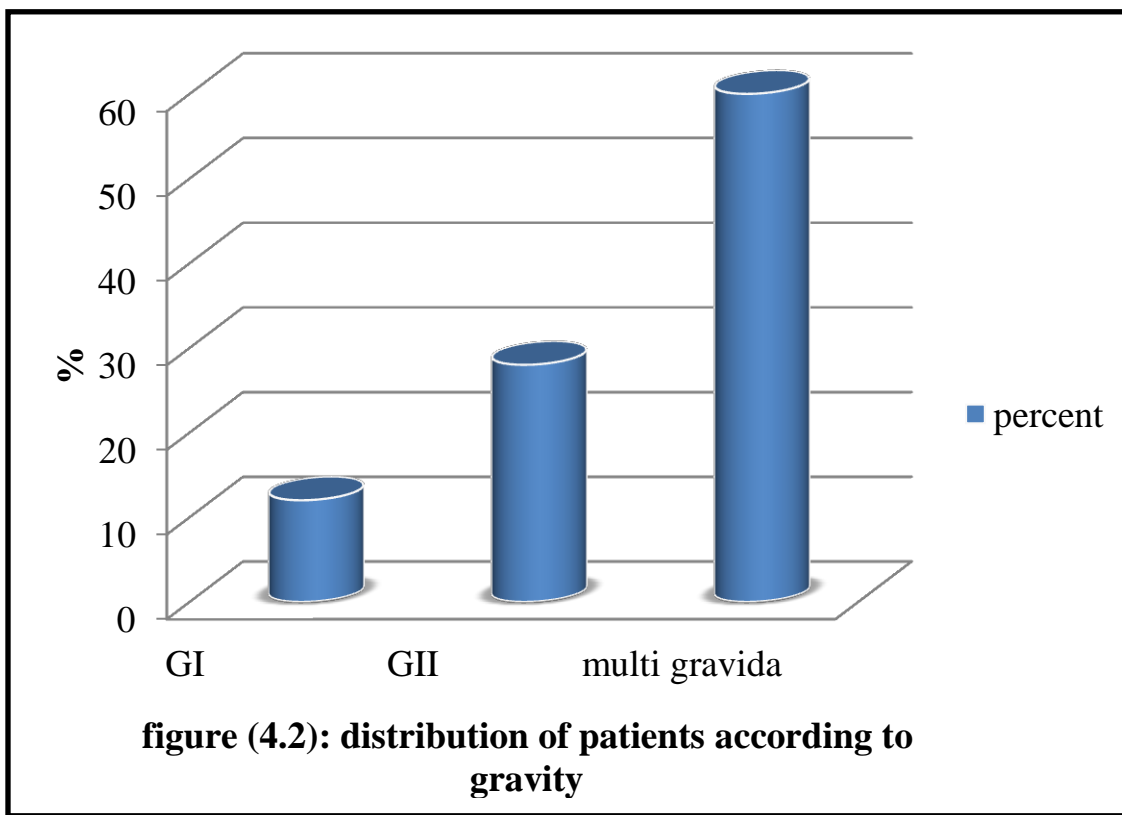


Table (4.3): Distribution of patients with yolk sac abnormalities according to parity.

		yolk sac abnormalities						Total
		absent	large	small	irregular	calcified	echogenic	
parity status	null parous	5	4	0	1	3	0	13
	uni parous	13	5	1	2	6	0	27
	bi parous	15	10	2	2	2	0	31
	multi parous	13	10	2	1	2	1	29
Total		46	29	5	6	13	1	100

Table (4-1) Model correlation test expressing the relationship between the parity status and yolk sac abnormalities :

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.326 ^a	15	.799
Likelihood Ratio	11.067	15	.748
N of Valid Cases	100		

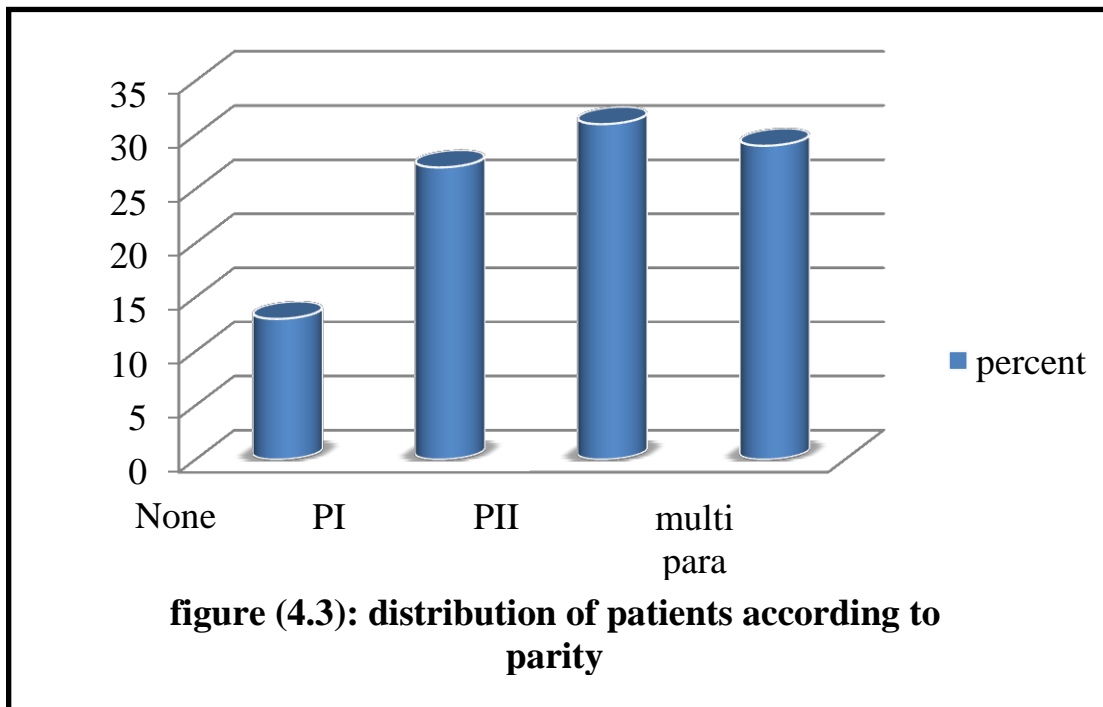


Table (4.4): Distribution of patients with yolk sac abnormalities according to history of chronic diseases.

chronic diseases	Frequency	Percent (%)
yes	5	3
No	95	95
Total	100	100

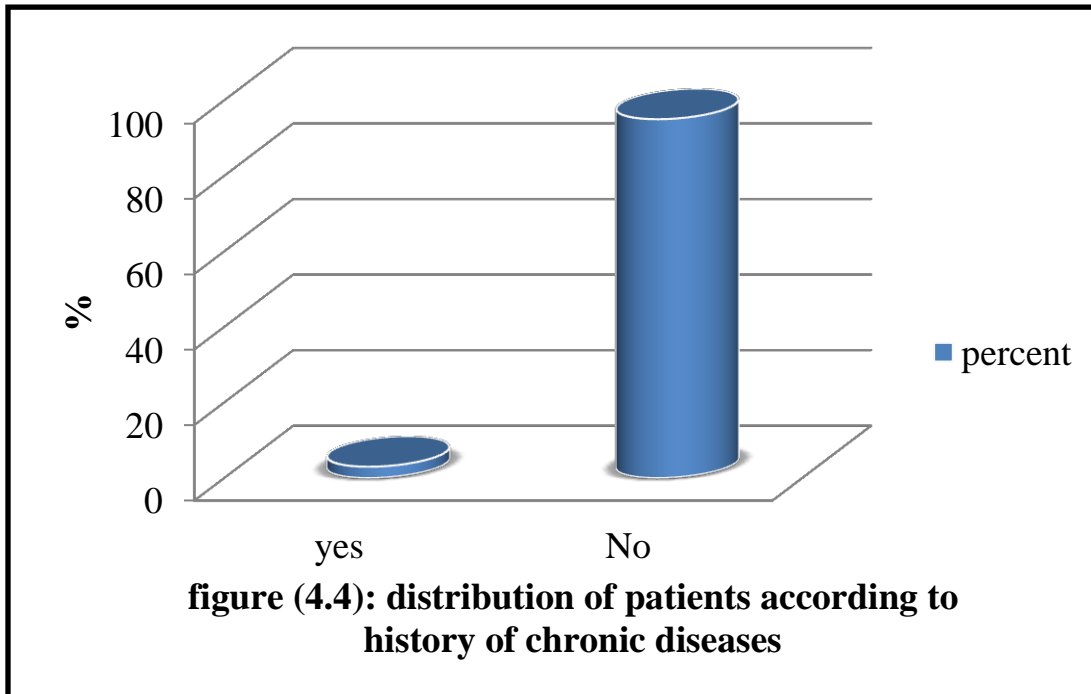


Table (4.5): Distribution of patients with yolk sac abnormalities according to the types of scanning technique.

Scanning technique	frequency	Percent (%)
TVS	59	59
TAS	41	41
Total	100	100

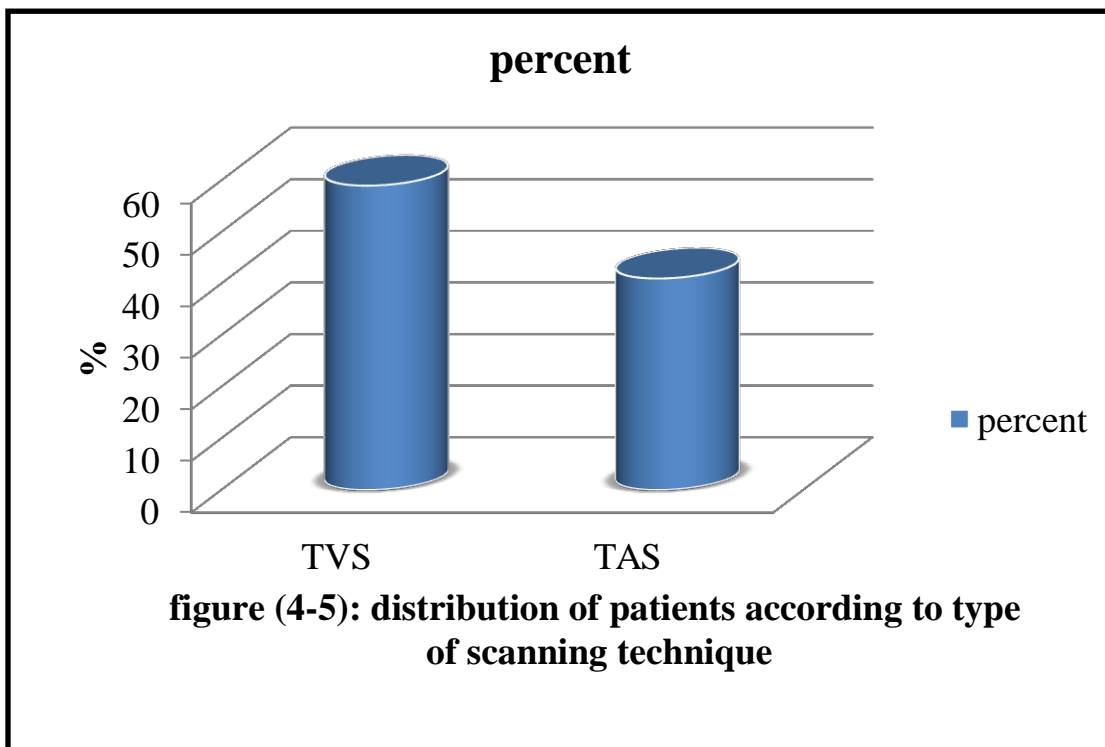


Table (4.6): Distribution of patients with yolk sac abnormalities according to the gestational ages.

		yolk sac abnormalities					Total	
		absent	Large	small	irregular	calcified		echogenic
gestational age	less than 8 weeks	30	19	3	5	11	1	69
	from 8 to 13 weeks	16	10	2	1	2	0	31
Total		46	29	5	6	13	1	100

Table (4-1) Model correlation test expressing the relationship between the gestational ages and yolk sac abnormalities :

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.169 ^a	5	.674
Likelihood Ratio	3.718	5	.591
N of Valid Cases	100		

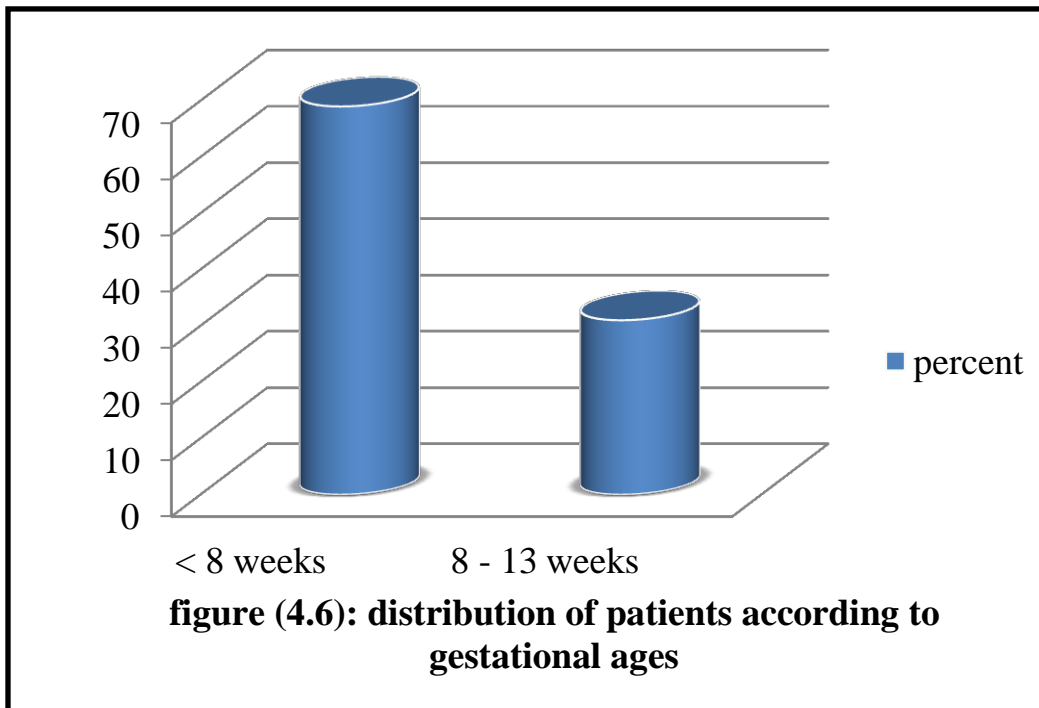


Table (4.7): Distribution of patients according to yolk sac abnormalities

yolk sac	frequency	Percent (%)
Absence	46	46
Large	29	29
Small	5	5
Irregular	6	6
Calcified	13	13
Echogenic	1	1
Persistent	0	0
Total	100	100

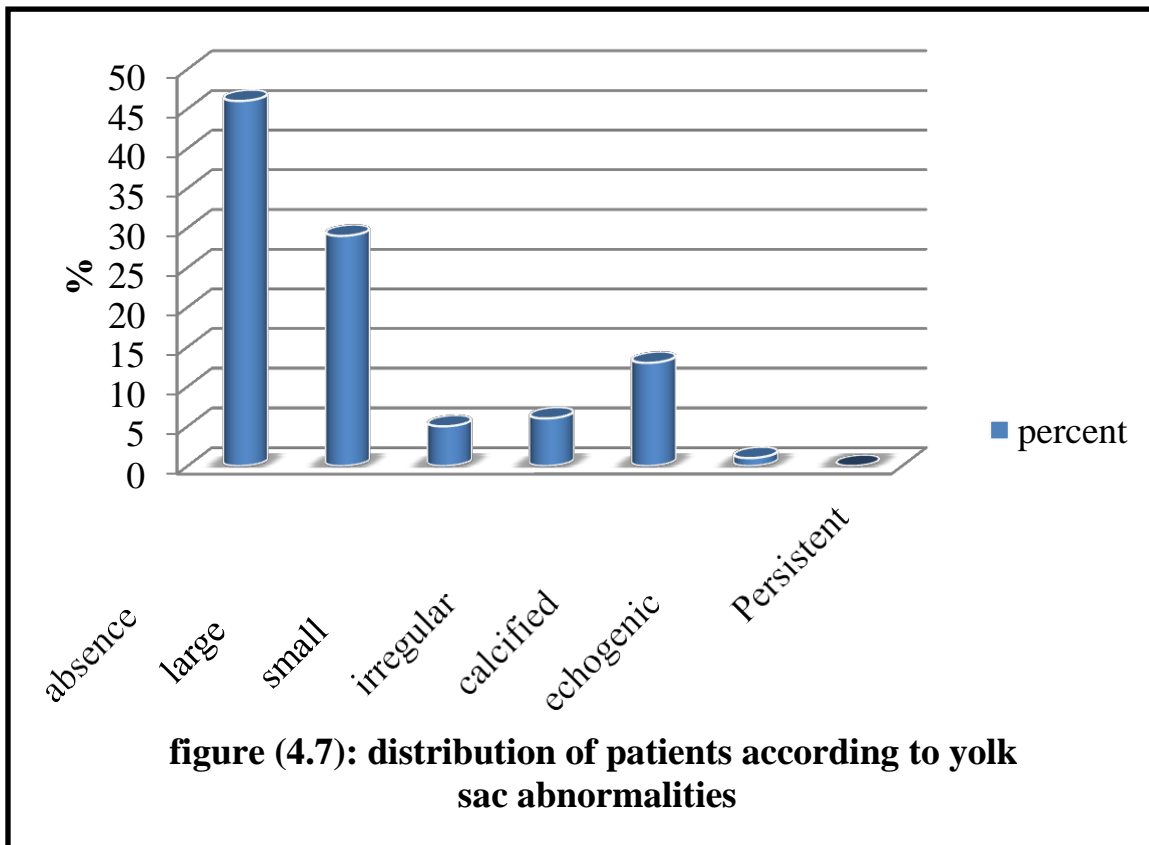


Table (4.8): Distribution of patients according to the complications associated with yolk sac abnormalities

complications	frequency	Percent (%)
No	17	17
Missed miscarriage	37	37
blighted ovum	46	46
Total	100	100

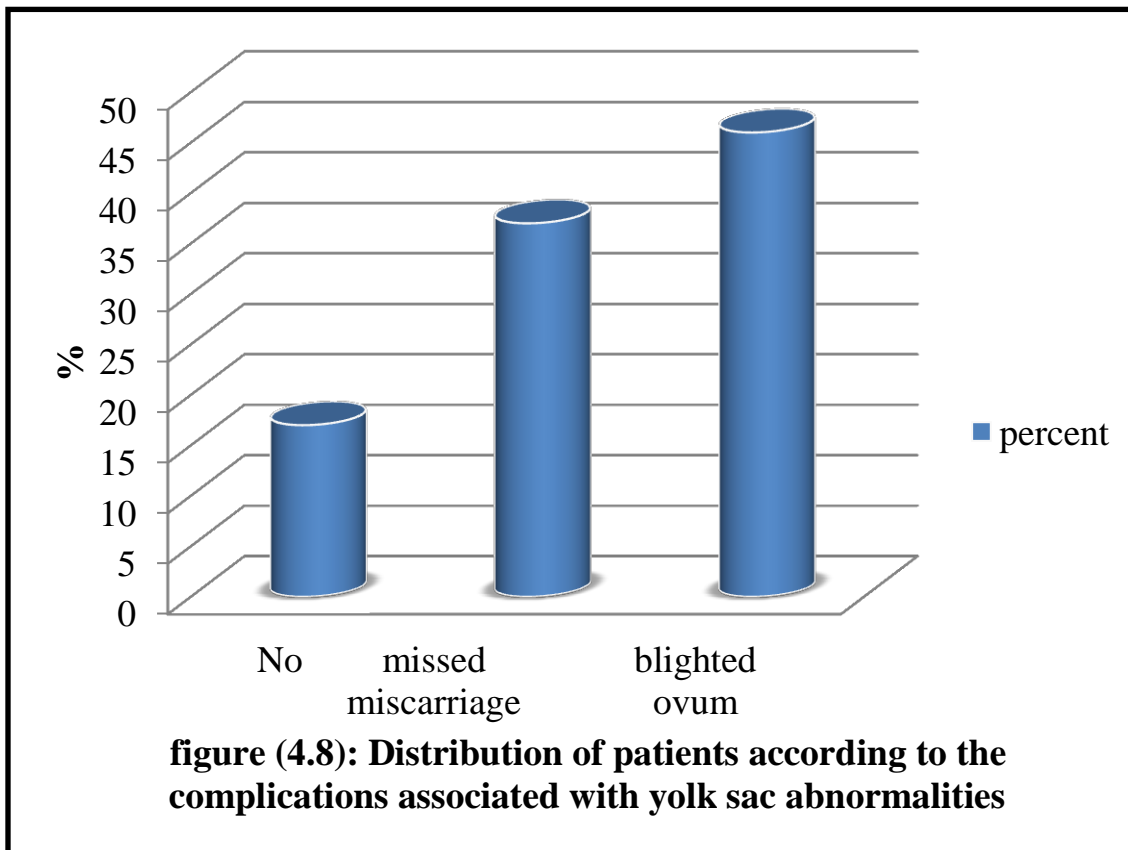
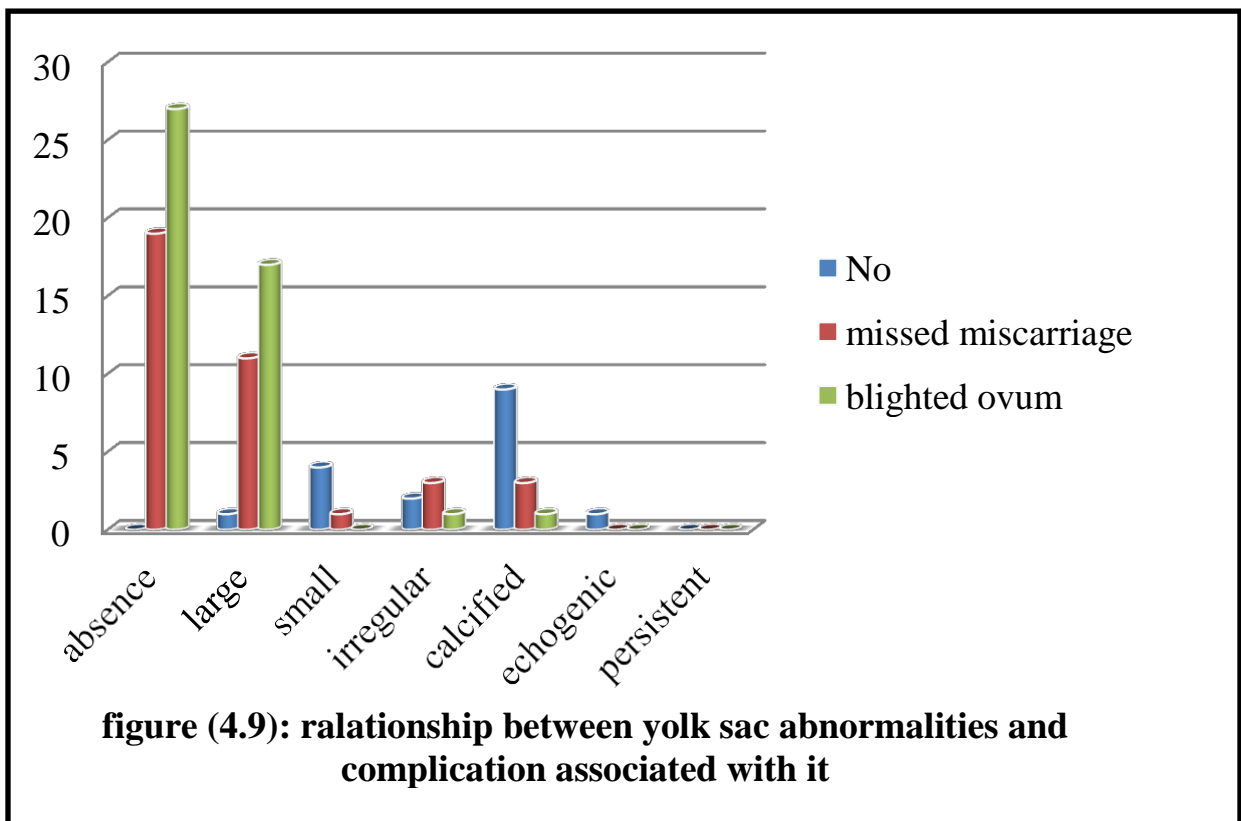


Table (4.9): Relationship between yolk sac abnormalities and complications associated with it.

complication	yolk sac abnormalities %						
	absence	large	small	irregular	calcified	Echogenic	Persistent
No	0	1	4	2	9	1	0
missed miscarriage	19	11	1	3	3	0	0
blighted ovum	27	17	0	1	1	0	0
P-value < 0.05							



Chapter Five

Chapter Five

Discussion, conclusion, and recommendations

5-1 Discussion:

This was observational analytical study conducted on 100 pregnant women in first trimester of pregnancy to determine the role of ultrasound in diagnosis of yolk sac abnormalities. Distribution of patients with yolk sac abnormalities according to age groups with 52% between 20 – 30 years, 38% were 30– 40 years, 7% were less than 20 years, and 3% were more than 40 years. With yolk sac abnormalities most common between 20 – 30 years age.

This agree with observational study conducted about value of yolk sac in predicting Pregnancy outcome during first trimester by Nawal Rajani, Khuteta Sushila, Jain Deepika, Khuteta Rakesh, Meena Vinay show 95 pregnant women of 20-30 years age group, and prospective Study about irregular yolk sac shape conducted by [Sinan Tan](#) et al show 183 pregnant women with mean age of 26.0 ± 5 years. Distribution of patients with yolk sac abnormalities according to gravity show 12% were primigravid, 28% were GII and 60% were multigravid patient.

Distribution of patients with yolk sac abnormalities according to parity show 13% were nonporous, 27% were PI, 31% were PII and 29% were multiparous patients. Yolk sac abnormalities most commonly occurred in Multigravid, paraII pregnant women. Distribution of patients with yolk sac abnormalities according to the history of chronic disease show 95% were normal and only 5% with history of chronic diseases. With no relationship between yolk sac abnormalities and history of chronic diseases.

Previous studies were not determined the relationship between yolk sac abnormalities and history of chronic diseases. Distribution of patients with yolk sac abnormalities according to type of scanning show 59% were examined transvaginally, and 41% were examined transabdominally, with transvaginal scanning technique more accurate than transabdominal technique.

Distribution of patients with yolk sac abnormalities according to the gestational age show 69% of patients below 8th week's gestational ages, and 31% of patients between 8 – 13 gestational ages. With yolk sac abnormalities most commonly occurred below 8th week GA.

This agree with cohort study about Abnormal Yolk Sac Characteristics carried out by Sanam Moradan, Mohammad Forouzesfar show 193 pregnant women with all pregnant women between 5-6.5th week gestational ages, and prospective Study about Irregular Yolk Sac Shape conducted by [Sinan Tan](#) et al show 183 pregnant women with all pregnant women of 6 to 8 weeks GA.

Distribution of patients according to the yolk sac abnormalities show 46% with absence of yolk sac, 29% with large yolk sac, 13% with calcified yolk sac, 6% with irregular yolk sac, 5% with small yolk sac, 1% with echogenic yolk sac, with absence of yolk sac was most common yolk sac abnormality.

Sinan Tan et al (2012) were found an irregular yolk sac was observed in (78.8%), an enlarged yolk sac in (12.1%), and an echogenic yolk sac in (9.1%).

Distribution of patient according to the complication associated with yolk sac abnormalities with blighted ovum 46% were most common followed by missed miscarriage 37%, with blighted ovum was most common complication.

Nawal Rajani, Khuteta Sushila, Jain Deepika, Khuteta Rakesh, Meena Vinay show 23 pregnant women with abnormal yolk sac, 19 of them with missed miscarriage, and 4 with blighted ovum.

Relationship between yolk sac abnormalities and complication associated with it show blighted ovum were most commonly associated with absence yolk sac (27% of 46%) and large yolk sac (17% of 29%). Missed miscarriage were most commonly associated with irregular yolk sac (3% of 6%). Normal pregnancy associated with small (4% of 5%), calcified (9% of 13%), and all pregnant women with echogenic yolk sac (P value < 0.05). Absence, large, and irregular yolk sac can predict poor pregnancy outcome, whereas small, calcified, and echogenic yolk sac most commonly associated with normal pregnancy.

This agree with Nawal Rajani, Khuteta Sushila, Jain Deepika, Khuteta Rakesh, Meena Vinay (2009-2010), and Sanam Moradan, Mohammad Forouzesfar (2009-2010) were found that yolk sac abnormalities in size (large), shape (irregular), and absence yolk sac can predict poor pregnancy outcome. And disagree with [Sinan Tan](#) et al found that the rates of spontaneous abortion were statistically similar for pregnancies with a regular yolk sac shape and those with an irregular shape.

5-2 Conclusion:

Ultrasound is most accurate modality to diagnosis the Yolk sac abnormalities during the first trimester of pregnancy and complication associated with it. Which most commonly affect middle aged (20-30 years), multi gravid, paraII pregnant women and were not related to history of chronic disease. Yolk sac abnormalities can be detected accurately by transabdominal or transvaginal approach below 8th week gestational age, with transvaginal approach more accurate than transabdominal approach. The most common yolk sac abnormalities were absence of yolk sac, large yolk sac, Calcified yolk sac, and Irregular yolk sac, Small yolk sac, echogenic yolk sac, and persistent yolk sac respectively. The most common complications of yolk sac abnormalities were blighted ovum, and missed miscarriage respectively. Absence of yolk sac, large yolk sac, and Irregular yolk sac which can predict poor pregnancy outcome. Small yolk sac, Calcified yolk sac, echogenic yolk sac, and persistent yolk sac which cannot be used to predict poor pregnancy outcome.

5-3 Recommendations:

All pregnant should do obstetrical ultrasound during the first trimester of pregnancy. Transvaginal ultrasound probe should be installed and used as routine on all obstetrical departments. Sonologist and sonographer should be trained to use transvaginal probe and be competent to diagnose the yolk sac abnormalities and any complication associated with it. During every first trimester ultrasound yolk sac should be evaluated carefully for any abnormalities. Yolk sac abnormalities should be reported on all first trimester ultrasound examination. More research studies should be done about yolk sac abnormalities and accuracy in prediction of pregnancy outcome.

References:

Alfred B et al. Can detection of the yolk sac in the first trimester be used to predict the outcome of pregnancy. Available from <http://www.ajronline.org/doi/pdf/10.2214/ajr.158.4.1546604>, 2019

Asim Kurjak et Frank A Chervenak, Donald school textbook of ultrasound in obstetrics and gynecology 1st edition, Italy: 2003. P.165-166.

Carol M Rumack, Diagnostic ultrasound. 4th ed. Mosby; Philadelphia, 2011. P1077-1096.

Devin Dean, Obstetrics and gynecological Ultrasound,. The burwin institute of diagnostic medical ultrasound in obstetrics, 1st edition, Lunenburg, Canada: 2005. P. 13-47.

First trimester Ultrasound of yolk sac abnormalities. 2018 at 5:30. http://www.ttuhschool.edu/elpaso/som/obgyn/obgyn101/my%20documents4/Ultrasound/1st_trimester_ultrasound_scanning.htm.

Nawal R et al , assess value of yolk sac in predicting pregnancy outcome during first trimester: observational study. Natl J Med Res, 2014.

Sanam M et Mohammad F, Are Abnormal Yolk Sac Characteristics Important Factors in Abortion Rates. Available from www.sid.ir/en/VEWSSID/J_pdf, 2018.

Sinan Tan et al. Irregular Yolk Sac Shape. Available from <http://www.jultrasoundmed.org/content/30/1/31.long> Accessed on Thursday 10/7/2014 at 10:00 pm.

Sinan Tan, et al Abnormal Yolk sac. Available from <http://www.jultrasoundmed.org/content/31/1/87>.

Sinan Tan et al. Abnormal sonographic appearances of the yolk sac which can be associated with adverse perinatal outcome, 2018.

Trish Chudleigh et Basky Thilaganathan, Obstetric Ultrasound How Why and When, 3rd edition, London: 2004. P. 40-41.

Yolk sac anatomy Available from <http://discovery.lifemapsc.com/in-vivo-development/yolk-sac/definitive-yolk-sac> Accessed on 2019.

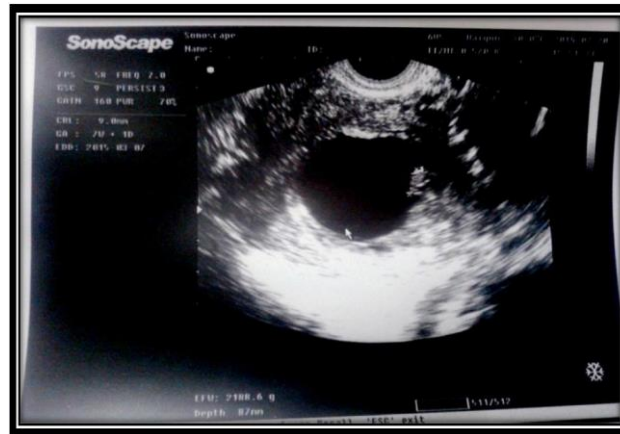
Yolk sac anatomy Available from http://en.wikipedia.org/wiki/Yolk_sac Accessed 2019 at 2:30 am.

Yolk sac physiology Available from <http://teleanatomy.com/placentaYolkSac.html#>

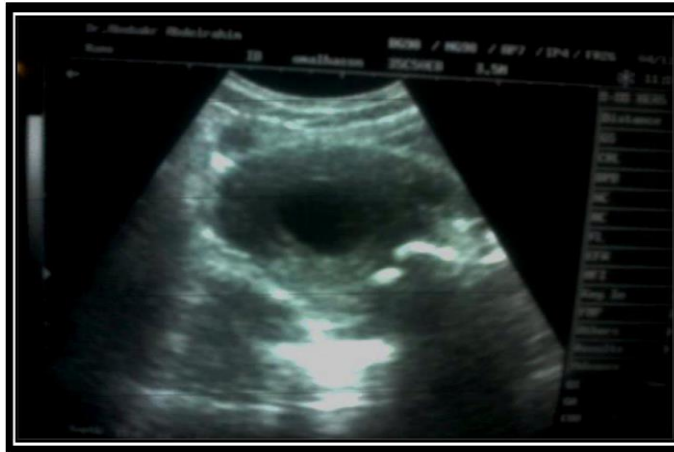
Appendix:



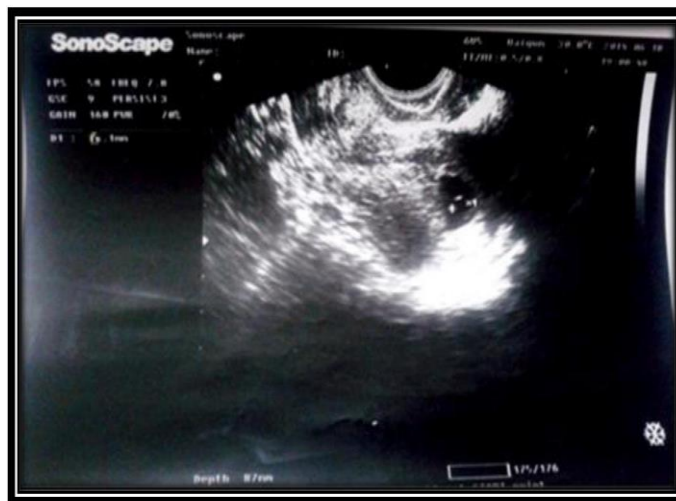
32 years old female GIII, ParaII, with GA 6th weeks +5 days complain of vaginal bleeding ultrasound show large yolk sac (11mm) associated with blighted ovum.



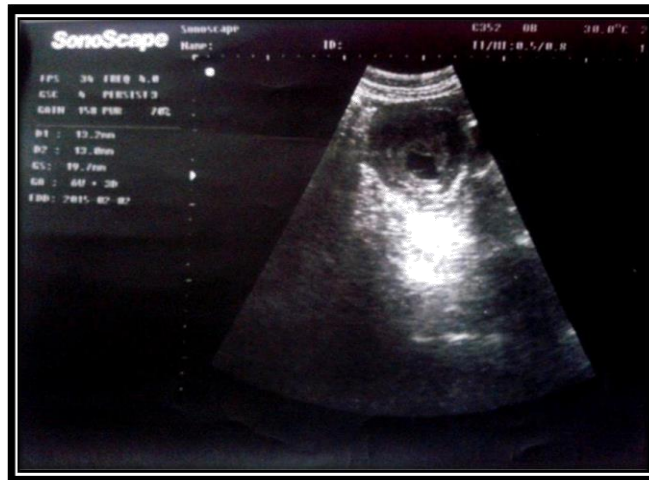
20 years old female GII, ParaI, with GA 7th weeks + 1day Ultrasound show absence of yolk sac associated with missed miscarriage.



22 years old female GI, Para0, with GA 8th weeks + 0day complain of vaginal bleeding
Ultrasound show absence of yolk sac associated with blighted ovum.



28 years old female GIII, ParaII, with GA 6th weeks + 2days Ultrasound show large yolk sac (6.1mm) associated with blighted ovum.



33 years old female multigravid, multiparous, with GA 6th weeks + 3 days Ultrasound show large yolk sac (13mm) associated with blighted ovum.



30 years old female GIII, ParaII, with GA 7th weeks + 4 days Ultrasound show absence of yolk sac associated with missed miscarriage.



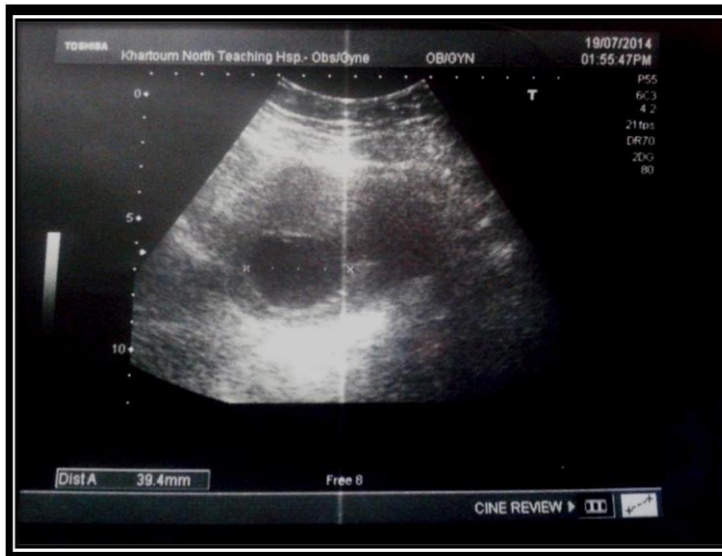
19 years old female GII, ParaI, with GA 6th weeks +4 days Ultrasound show absence of yolk sac associated with blighted ovum.



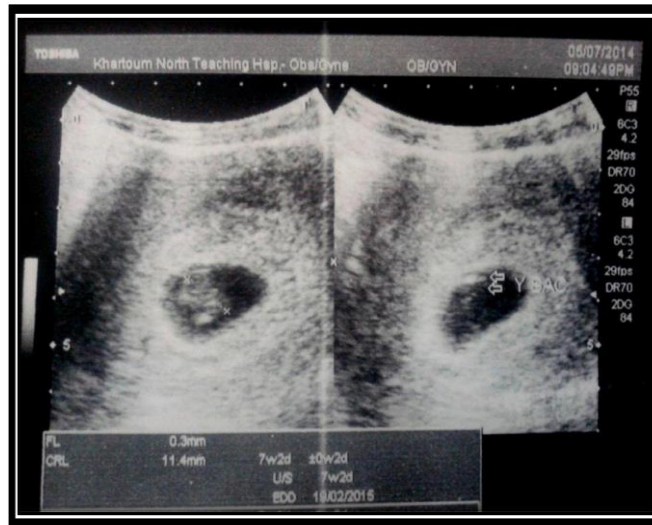
30 years old female multigravid, multiparous, with GA 8th weeks + 1day Ultrasound show large yolk sac (8.5mm) associated with missed miscarriage.



24 years old female GIII, ParaI, with GA 6th weeks +0 day Ultrasound show irregular yolk sac associated with blighted ovum.



23 years old female GIII, ParaII, with GA 8th weeks + 3 days Ultrasound show absence of yolk sac associated with blighted ovum.



19 years old female GI, Para0, with GA 7th weeks + 2 days Ultrasound show calcified yolk sac associated with normal pregnancy.



34 years old female multigravid, ParaII, with GA 7th weeks + 6 days Ultrasound show large yolk sac (9mm) associated with missed miscarriage



20 years old female GII, ParaI, with GA 6th weeks + 0 day Ultrasound show absence of yolk sac associated with blighted ovum.



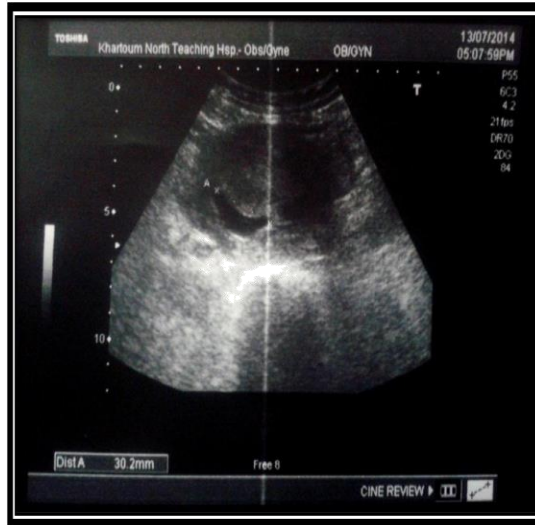
33 years old female multigravid, ParaII, with GA 7th weeks + 1day Ultrasound show absence of yolk sac associated with blighted ovum.



20 years old female GII, ParaI, with GA 6th weeks + 0 day Ultrasound show large yolk sac (6.6mm) associated with blighted ovum.



33 years old female mltigravid, multiparous, with GA 7th weeks + 4 days Ultrasound show absence of yolk sac associated with missed miscarriage



23 years old female GII, ParaI, with GA 7th weeks + 4 days Ultrasound show absence of yolk sac associated with blighted ovum.



25 years old female GIII, ParaII, with GA 7th weeks + 6 days Ultrasound show absence of yolk sac associated with blighted ovum.



30 years old female multigravid, ParaII, with GA 7th weeks + 1day Ultrasound show absence of yolk sac associated with missed miscarriage.



28 years old female GIII, ParaI, with GA 8th weeks + 2 days Ultrasound show large yolk sac (7.8mm) associated with blighted ovum.



30 years old female multigravid, ParaII, with GA 8th weeks + 6 days Ultrasound show absence of yolk sac associated with missed miscarriage.



20 years old female GII, ParaI, with GA 7th weeks + 1 day Ultrasound show absence of yolk sac associated with blighted ovum.



18 years old female GI, Para0, with GA 8th weeks + 2 days Ultrasound show absence of yolk sac associated with blighted ovum.



34 years old female GIII, ParaII, with GA 8th weeks + 5 days Ultrasound show absence of yolk sac associated with missed miscarriage.



19 years old female GI, Para0, with GA 6th weeks + 4 days Ultrasound show absence of yolk sac associated with blighted ovum.



29 years old female GIII, ParaII, with GA 8th weeks + 2 days Ultrasound show large yolk sac (8mm) associated with blighted ovum.



20 years old female GII, ParaI, with GA 7th weeks + 1day Ultrasound show absence of yolk sac associated with missed miscarriage.



30 years old female multigravid, ParaII, with GA 7th weeks + 5days Ultrasound show small yolk sac (1.8mm) associated normal pregnancy.



26 years old female multigravid, ParaII, with GA 7th weeks + 1day Ultrasound show absence of yolk sac associated with missed miscarriage.



28 years old female multigravid, ParaII, with GA 6th weeks + 0day Ultrasound show small yolk sac (1.9mm) associated with blighted ovum.



30 years female, GIII, PII, with GA 8weeks + 5days ultrasound show large yolk sac (9.2mm) associated with blighted ovum



24 years female, GII, PI, with GA 7 weeks + 2 days ultrasound show large yolk sac (8.6mm) associated with missed miscarriage.

