

**The role of ultrasound in the prognosis of first trimester pregnancy outcome**Marwa Gaber Ahmad Ahmad¹, Dr. Hossam Hassan El-Ktatny², Dr. Ahmad Abd-Elhamid Ahmad saleh²¹Resident of Obstetrics and Gynecology in Sohag General Medical Center, Egypt²Obstetrics and Gynecology Department, Faculty of Medicine, Al-Azhar University, EgyptEmail: marwagaber688@gmail.com

Abstract: Background: Ultrasonography is a useful method for determining the status of early pregnancy. First trimester sonography is useful for dating, assessing a number of gestation, establishing location, and even detecting some early Malformation. Ultrasonography does have a high sensitivity for detecting abnormalities of the gestational sac, yolk sac, and embryo, which predict poor results in addition to recording normal growth. The goal of this study was to see if the diameter of the yolk sac and the early embryonic heart rate might be used as predictors of pregnancy outcomes.

Methods: This prospective cross sectional study that carried out on 150 patients in Al-Azhar university hospital Assuit, outpatient clinic and obstetrics and gynecology department in un complicated singleton pregnancy. A detailed medical and surgical history was taken in order to exclude any potential medical or surgical complications that might affect our research. The patient underwent a general and physical examination. Nomograms were constructed for each sonographic parameter; measurements were calculated, and the values were compared among the groups of miscarriage and ongoing pregnancy.

Results: Abortion rate in relation to the total number of the study was (9.7%) Mean value of yolk sac among miscarriage Group was smaller than ongoing pregnancy groups. Mean value of gestational sac among miscarriage group was smaller than ongoing pregnancy groups. Mean value of embryonic heart rate among miscarriage group was smaller than ongoing pregnancy groups. These smaller values of yolk sac, gestational sac and embryonic heart rate are predictors for miscarriage.

Conclusion: Smaller values of yolk sac, gestational sac and embryonic heart rate are prognostic factors for miscarriage.

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Keywords: Ultrasonography -yolk sac diameter-gestational sac diameter -embryonic heart rate prognostic factors.

1. Introduction

Ultrasonography is a useful method for determining the status of early pregnancy. First trimester sonography is useful for dating, assessing a number of gestation, establishing location, and even detecting some early malformation (Jaiuix *et al.*, 2005).

Ultrasonography does have a high sensitivity for detecting abnormalities of the gestational sac, yolk sac, and embryo, which predict poor results in addition to recording normal growth (Callen, 2008)

About 30-40% of human pregnancies end in spontaneous abortion in the first trimester following implantation, according to estimates. A large number of miscarriages occur early in pregnancy; however the rate of spontaneous abortion gradually declines to 2-5 % once fetal cardiac activity develops. Sonographically, however, the intrauterine gestational sac is the first to appear, followed by the yolk sac then the fetal pole with heart activity. The yolk sac is the earliest embryonic structure seen inside the gestational sac. It normally appears as a round anechoic area

between the 5th and 12th weeks of pregnancy, then degenerates (Adiga *et al.*, 2015).

The results of conventional ultrasound sonography were evaluated and are thought to have prognostic significance when combined with the other clinical and maternal variables analyzed (BaeS, *et al.*, 2011). The morphological properties of the yolk sac, appropriate transvaginal visualization of the embryo, shifts in fetal heart rate, and macroscopic lesions of the placenta are some of the measures obtained with conventional ultrasound that are regarded prognostic variables (Papaioannou *et al.*, 2011).

The thickened decidua of the gestational sac is the first sonographic indication of pregnancy. When the sac's mean diameter is 2 to 3 mm, it can be identified by transvaginal ultrasound by four weeks and three days of pregnancy (Morin *et al.*, 2005).

When the embryo has been 1 to 2 mm long, it can be detected via transvaginal ultrasound. Both the embryo and the gestational sac ought to be growing 1 mm each day at 5 to 7 weeks (Morin *et*

al., 2005).

Within the gestational sac, the yolk sac is the first embryonic structure visible on sonography. It is normally seen as a round anechoic area between the 5th and 12th weeks of pregnancy (*Varelas et al., 2007).*

In terms of predicting pregnancy loss, a yolk sac's low quality and early regression are more specific than its enormous size. A rather big yolk sac, even if normal in shape, could be an indicator of miscarriage when an embryo is undetected (*Cho et al., 2006).*

A human's heart is a vital organ. Between Three and Six weeks following ovulation, a human embryo's cardiovascular development begins. Heart function is the first indication of independent cardiac activity which may be investigated using non-invasive procedures like Doppler ultrasound. Heart activity directly adjacent to the yolk sac, suggesting a living embryo, might not be visible till the embryo reaches 5 mm; an embryonic heart rate of fewer than 100 beats a minute is normal from 5.5 to 6.5 weeks. During the next three weeks, the heart rate rapidly rises to 180 beats a minute (*Morin et al., 2005).*

Several investigations have found a link between severe embryonic bradycardia and fetal loss (*Varelas et al., 2007).*

Aim of the work:

To evaluate the measurement of gestational sac diameter, yolk sac diameter and embryonic heart rate during the first trimester, and their usefulness as predictive indicators of first trimester pregnancy result.

2. Patients and Methods

Type of the study;

A prospective study. This study was held on 150 patients who attended the out-patient clinic or the causality department of Obstetrics & Gynecology, in Tahta general hospital.

The study group was subdivided into; group of patients who aborted (14 patients) and another group who continued their pregnancy and proceeded into second trimester (131).

However, 5 patients did not complete their follow up program with us, and hence were considered as a drop of our cases leaving 145 patients who were eligible for analysis (14 patients in the group who aborted, and 131 patients in the group that continued).

Criteria for patient selection:

Inclusion criteria:-

1. Pregnant women who had regular menstrual cycles prior to conception.
2. A patient whose last menstrual periods are precisely known.

3. Patients got their initial ultrasonography at their first visits (between 5 and 6 weeks) to verify their gestational age.
4. Singleton pregnancies.

Exclusion criteria:

1. Patients with vaginal bleeding.
2. Patient unsure of date.
3. Patient with low abdominal pain and cramping.
4. Patient with chronic diseases.
5. Any uterine pathology as myomas or malformation.

All cases were subjected to the following:

1. Informed written consent obtained from the participant.
2. Full history taking.
3. General examination.
4. Gynecological examination.
5. Ultrasonography examination at 6wk – 10wk – 13wk

All patients will subject to the following;

Personal history;

Name, age, parity, occupation, place of residence, and special habits.

Present history;

Obstetric history;

History of previous preterm labor, previous abortion, previous full term deliveries, mode of deliveries and fetal outcome.

Menstrual history;

For gestational age estimation, woman had to have had regular cycles for last 3 months prior becoming pregnant, not be using contraceptive pills throughout this time, and be sure of her dates.

Past history;

A history of medical disorders, abdominal surgeries, pharmacological therapy, or allergies, as well as a history of taking tocolytic drugs.

Family history;

For any similar condition.

Sonographic examination

Sonographic parameters:

1. **Gestational sac parameter (MSD)** including diameter, shape, contour, position, wall, and presence of subchorionic hematoma.
2. **Fetal parameters;** including: embryonal heart rate (EHR), and yolk sac diameter.

1-Mean Sac Diameter (MSD) (mm);

The height, width, and depth of the fluid part of the sac collected at the fluid chorionic tissue interface are measured to obtain an MSD by scanning in 2 plans at right angles to one another and calculating the mean of the 3 measures. It was measured in millimeters.

2-Fetal Heart Rate (FHR) (bpm);

FHR was determined by pulsed width real time Doppler in a longitudinal section of the fetus, identifying the heart by the movement of the valves and placing the sampling gate on the fetal heart. It

was calculated from 2 consecutive fetal heart Doppler waves identified.

3-Yolk sac diameter;

Vesicular, well defined echo-free structure .It was measured in millimeters.

Normal pregnancy considered if pregnancy continue till 13 weeks and abnormal outcome if ended in abortion.

Primary outcomes

Pregnancy outcome in relation to first trimester evaluation by u/s parameter (gestational sac diameter, Yolk sac diameter, shape and fetal heart rate).

Secondary outcome parameters

Detection of abnormality and any pregnancy loss during 1st trimester evaluation by u/s parameter. The abnormal values for gestational sac diameter, yolk sac diameter and embryonic heart rate was > 95th percentile or < 5th percentile for gestational age, or ± 2 SD for gestational age.

Possible Risk

No risk detected.

Sample size:

Include 150 pregnant women at first trimester.

3. Results:

This prospective cross sectional study that carried out on 150 patients in Al-Azhar, Assuit university hospital, outpatient clinic and obstetrics

and gynecology department in uncomplicated singleton pregnancy .First scan done at 6 weeks follow up at 10 and 13 weeks.

Continued pregnancy group=group 1

Miscarriage group=group 2

Table (1): continuation of pregnancy rate and miscarriage rate in relation to the total number of the study.

	No. (145)	Percent %
Continued pregnancy	131	90.3
Miscarriage	14	9.7

5 women were lost for follow-up

This table show that miscarriage rate in relation to total number of the study was 9.7%

Table (2): Age distribution of the studied women

Age (years)	No. (150)	%
< 25	37	24.7%
25 - < 30	60	40.0%
≥ 30	53	35.3%
Mean \pm SD (Range)	27.31 \pm 4.47 (19.0-44.0)	

This table show the distribution of the studied women which show that the mean age is 27.31 \pm and the range is 19.0 - 44.0

Table (3): comparison between gestational sac diameter at week 6,10,13

	6 weeks	10 weeks	13 weeks	P-value ¹	P-value ²	P-value ³
GS (mm)						
Mean \pm SD	16.82 \pm 1.72	41.42 \pm 2.95	65.76 \pm 4.62	0.000*	0.000*	0.000*
Range	12.0-19.5	35.0-47.0	42.0-74.0			

This table show mean of GS diameter at 6 w (16.82 \pm 1.72), 10w (41.42 \pm 2.95) and 13 weeks (65.76 \pm 4.62).There is significant difference

between them (p- value 0.000).the range of GS diameter at 6 w (12.0-19.5), 10w (35.0-47.0) 13 weeks (42.0-74.0).

Table (4): Comparison between yolk sac diameter at week 6,10,13:

	6 weeks	10 weeks	13 weeks	P-value ¹	P-value ²	P-value ³
YS (mm)						
Mean \pm SD	3.09 \pm 0.55	4.91 \pm 0.84	6.48 \pm 0.48	0.000*	0.000*	0.000*
Range	2.0-4.5	3.0-7.0	5.4-7.2			

This table show mean and range of YS diameter at 6 (3.09 \pm 0.55), 10 (4.91 \pm 0.84) and 13 weeks

(6.48 \pm 0.48). There is significant difference between them (p- value 0.000)

Table (5) Comparison between fetal heart rate at week 6,10,13

	6 weeks	10 weeks	13 weeks	P-value ¹	P-value ²	P-value ³
FHR						
Mean \pm SD	120.98 \pm 11.39	140.22 \pm 9.69	150.48 \pm 5.92	0.000*	0.000*	0.000*
Range	90.0-139.0	100.0-155.0	135.0-162.0			

This table show mean and range of FHR at 6 (120.98 \pm 11.39), 10 (140.22 \pm 9.69) and 13 weeks

(150.48 \pm 5.92). There is significant difference between them (p- value 0.000)

Table (6): Comparison between group 1 (continued pregnancy) and group 2 (miscarriage) as regarding age

Age (years)	Continued pregnancy (n= 131)		Miscarriage(n= 14)		P-value
	No.	%	No.	%	
< 25	34	91.9%	3	8.1%	0.751
25 - < 30	54	91.5%	5	8.5%	
≥ 30	43	87.8%	6	12.2%	

This table show comparison between group 1 (continued pregnancy) and group 2 (miscarriage) as regarding age. There is no significant difference

between continued pregnancy group and miscarriage group as regarding age (P-value 0.751)

Table (7): Comparison between group 1(Continued pregnancy) and group 2(Miscarriage) regarding gravidity, parity, living children and history of abortion.

Obstetric history	Continued pregnancy(n= 131)		Miscarriage(n= 14)		P-value
	No.	%	No.	%	
Gravida:					
One	29	96.7%	1	3.3%	0.304
Two	37	92.5%	3	7.5%	
Three	35	89.7%	4	10.3%	
Four or more	30	83.3%	6	16.7%	
Parity:					
None	36	92.3%	3	7.7%	0.090
One	38	97.4%	1	2.6%	
Two	34	89.5%	4	10.5%	
Three or more	23	79.3%	6	20.7%	
Living children:					
None	36	92.3%	3	7.7%	0.079
One	36	92.3%	3	7.7%	
Two	39	95.1%	2	4.9%	
Three or more	20	76.9%	6	23.1%	
Abortion:					
No abortion	102	89.5%	12	10.5%	0.735
Abortion	29	93.5%	2	6.5%	

This table show Comparison between group 1(Continued pregnancy) and group 2(Miscarriage) regarding gravidity, parity ,living children and history of abortion .there is no significant difference between group 1(Continued

pregnancy)and group 2(Miscarriage) regarding gravidity (P-value 0.304) , parity(P-value 0.090) ,living children (P-value 0.079) and history of abortion (P-value 0.735)

Table (8): Comparison between group 1 and group 2 regarding Gestational sac at 6,10 and 13 weeks

	Continued pregnancy (n= 131)		Miscarriage(n= 14)		P-value
	Mean ± SD		Mean ± SD		
GS: (mm)					
6 weeks	16.99 ± 1.62		15.21 ± 2.08		0.000*
10 weeks	41.81 ± 2.79		38.27 ± 2.10		0.000*
13 weeks	65.76 ± 4.62		--		--

This table shows comparison between group 1 and group 2 regarding gestational sac at 6 weeks, mean value of Gestational sac at 6 week in group 1 was 16.99 ± 1.62 compared to 15.21 ± 2.08 in group 2. The difference in gestational sac at 6 weeks was statistically significant between groups 1 and 2 (p. value 0.000).

Mean value of gestational sac at 10 weeks in group 1 was 41.81 ± 2.79 compared to 38.27 ± 2.10 in group 2. The difference in gestational sac at 10 weeks was statistically significant between groups 1 and 2 (p. value 0.000).

Table (9): Comparison between group 1 and group 2 regarding yolk sac at 6,10 and 13 weeks

	Continued pregnancy(n= 131)	Miscarriage (n= 14)	P-value
	Mean ± SD	Mean ± SD	
YS: (mm)			
6 weeks	3.17 ± 0.52	2.42 ± 0.41	0.000*
10 weeks	5.08 ± 0.70	3.13 ± 0.13	0.000*
13 weeks	6.48 ± 0.48	--	--

This table shows comparison between group 1 and group 2 regarding yolk sac at 6 week, mean value of yolk sac at 6 week in Group 1 was 3.17 ± 0.52 compared to 2.42 ± 0.41 in Group 2. At 6 weeks, the difference between groups 1 and 2 in terms of yolk sac was statistically significant (p. value 0.000).

Mean value of yolk sac at 10 week in group 1 was compared to 5.08 ± 0.70 in group 2. At 10 weeks, the difference between groups 1 and 2 in terms of yolk sac was statistically significant (p. value 0.000).

Table (10): Comparison between group 1 and group 2 regarding fetal heart rate at 6, 10 and 13 week.

	Continued pregnancy(n= 131)	Miscarriage(n= 14)	P-value
	Mean ± SD	Mean ± SD	
FHR			
6 weeks	122.29 ± 10.33	108.00 ± 14.10	0.000*
10 weeks	142.09 ± 6.63	116.36 ± 9.59	0.000*
13 weeks	150.48 ± 5.92	--	--

This table shows comparison between group 1 and group 2 regarding embryonic heart rate at 6 week, mean value of embryonic heart rate at 6 week in group 1 was 122.29 ± 10.33 compared to 108.00 ± 14.10 in group 2. The difference in fetal heart rates between groups 1 and 2 was statistically significant at 6 weeks (p. value 0.000).

Mean value of embryonic heart rate at 10 week in group 1 was 142.09 ± 6.63 compared to 116.36 ± 9.59 in group 2. There was no statistically significant difference between group 1 and group 2 regarding fetal heart rates at 10 weeks (p. value 0.000).

4. Discussion

The first trimester of pregnancy is made up of the first 12-13 weeks of a woman's pregnancy, which is calculated from the first day of her last menstrual period (LMP). The imaging chosen method for both diagnosis and imaging follow-up during first trimester is transvaginal ultrasonography (TVUS). Ultrasound imaging has several advantages, including its widespread availability, low cost, and ability to acquire real-time, high-resolution images (Murugan et al., 2020).

The presence of serum beta-human chorionic gonadotropin (β -hCG) is commonly used to make the initial pregnancy diagnosis. In the first and second trimesters, ultrasound is used to determine the pregnancy's gestational age and, ultimately, to assess fetal anatomy. Pelvic ultrasound is used in the first trimester to determine the existence or lack of an intrauterine gestational sac and to assess the pregnancy's viability (Murugan et al., 2020).

It can also be used to determine if a pregnancy is ectopic as well as other pregnancy-related complications. The American Institute of Ultrasound in Medicine has defined practice criteria for performing and documenting obstetric ultrasound images (Dougherty et al., 2020).

Approximately 15-20% of the pregnancies are terminated by miscarriage. Yolk sac first emerges at 5 weeks of pregnancy and may be seen on ultrasound as a prominent sonolucent center with an echogenic rim. It grows in size up to 8 to 11 weeks of pregnancy and then vanishes by 12 weeks. Previous research has linked embryonic health to the properties of the gestational sac, yolk sac, and embryonic heartbeats (PK et al., 2018).

The yolk sac's size, structure, and function have all been explored in different research. Miscarriage risk was considerably higher in pregnancies with a yolk sac diameter greater than 5 mm. Pregnancies with enlarged yolk sacs resulted in 37.5 % of miscarriages, while pregnancies with irregular yolk sacs resulted in 3.8 % of miscarriages. As pregnancy with normal yolk sac advances in the first trimester, the frequency of complications reduces (AbdEllatif et al., (2018).

Regular yolk sac has a sensitivity of high to 94.2 % in predicting normal outcome. As early as 5 weeks, the embryonic heart beat can usually be identified with better visual resolution. In this regard, Doppler researches as well as motion mode (M-mode) are also useful. Among 6 and 10 weeks of pregnancy, the fetal heart rate rose significantly from 118 to 167 beats per minute. Early in gestation (6-9 weeks of pregnancy), a slow embryonic heart rate has been linked to a high

likelihood of eventual fetal death, according to studies. An embryonic heart rate of less than 100 BPM is considered abnormal, and 83.3 % of pregnancies end in miscarriage (**Cheung and Sizer, 2020**).

The aim of this work is to evaluate the measurement of gestational sac diameter, yolk sac diameter and embryonic heart rate during the first trimester, as well as their importance as prognostic indicators of first trimester pregnancy outcomes.

In this study we showed that miscarriage rate in relation to total number of the study was 9.7%

According to **Varelas et al. (2008)**, spontaneous miscarriage occurred in 12 of 219 pregnancies (5.48%). During the 42nd and 55th day of gestation, all of the women whose pregnancies ended in a spontaneous miscarriage (group IV) were investigated (mean: 45 days).

In this study we found that **distribution of the studied women which show that the mean age is 27.31±** and the range is 19.0 - 44.0

AbdEllatif et al. (2018) showed demographic data of the studied patients showed demographic data of the studied patients. Females with age less than 20 was 14(14%), age from 20-35 was 76(76%) and age less than 35 was 10(10%).

In this study we cleared that mean and range of GS diameter at 6, 10 and 13 weeks. There is significant difference between them (p- value 0.000)

AbdEllatif et al. (2018) showed distribution of the studied patients regarding gestational sac diameter at different period of follow up. At 6 weeks, gestational sac diameter from 2.5-3 was higher 28(28%). At 9 weeks, gestational sac diameter from 2.5-3.5 was higher 41(41.8%) and at 12 weeks gestation sac diameter 6.0+ was higher 43(46.2%)

In this study we illustrated that mean and range of YS diameter at 6,10 and 13 weeks. There is significant difference between them (p- value 0.000)

AbdEllatif et al. (2018) showed distribution of the studied patients regarding yolk sac diameter at different period of follow up. At 6 weeks, yolk sac diameter 6.0+ was higher 40(40%). At 9 weeks, yolk sac diameter 6.0+ was higher 56(57.1%) and at 12 weeks yolk sac diameter.

Varelas et al. (2008) showed the yolk sac had not been visible in 5/12 instances (41.66%) of group IV (women whose pregnancy resulted in first trimester spontaneous miscarriage), but was visible in 6/135 (7.84%) of group I (p < 0.001). Group IV had a significantly smaller yolk sac diameter than group I (women who were tested between the 42nd and 55th day (6–7 weeks + 6 days) (p = 0.001). The yolk sac diameter was significantly linked with increasing gestational age in pregnancies which lasted longer than 12 weeks (r: 0.444, p < 0.001)

I et al. (2019) revealed that there was a significant positive association among YSD and gestational age in miscarriage group while non-significant correlation in other groups.

In this study we showed that mean and range of FHR at 6, 10 and 13 weeks. There is significant difference between them (p- value 0.000)

Varelas et al. (2008) showed that the embryonic heart rate of group IV (women whose pregnancy resulted in first trimester spontaneous miscarriage) was significantly lower than that of group I (Women who were tested between the 42nd and 55th day (6–7 weeks + 6 days) have been included. The embryonic heart rate was significantly linked with increasing gestational age (r: 0.564, p < 0.001) in pregnancies which lasted longer than 12 weeks.

In this study we demonstrated that there is no significant difference between continued pregnancy group and miscarriage group as regarding age (P-value 0.751)

We found no significant differences in gravidity (P-value 0.304), parity (P-value 0.090), living children (P-value 0.079), or history of abortion (P-value 0.735) between groups 1 (continued pregnancy) and 2 (miscarriage) in this study.

Age, BMI, gravidity, parity, mode of conception, and clinical history were all not significant to < 0.05, according to **Detti et al. (2020)**.

In a study by **Iet al. (2019)**, there were 52 pregnant women in their first trimester from 6 weeks till 12 weeks gestation. Informed consent was taken from every patient. He showed that there were no statistical differences in the age, parity and BMI in the studied groups.

Ibrahim et al. (2018) found no statistical differences in age, parity, BMI, gestational age at hemorrhage onset, or number of prior abortions amongst the three groups studied.

Kapfhamer et al. (2018) showed that statistical difference among the studied groups regarding age but no significant difference as regards parity, Body Mass Index (BMI).

In this study we showed that mean value of Gestational sac at 6 week in group 1 was 16.99 ± 1.62 compared to 15.21 ± 2.08 in group 2. The difference in gestational sac at 6 weeks was statistically significant between groups 1 and 2 (p. value 0.000).

In the study in our hands, we found that Mean value of gestational sac at 10 week in group 1 was 41.81 ± 2.79 compared to 38.27 ± 2.10 in group 2. The difference in gestational sac at 10 weeks was statistically significant between groups 1 and 2 (p. value 0.000).

AbdEllatif et al. (2018) showed the relation between gestational sac diameter at different gestational age period and its relation to the

outcome of pregnancy, the gestational sac diameter show a significant decreasing in the fetal loss group at 6, 9 and 12 weeks, so the GS diameter was a good predictor to fetal loss ($p < 0.05$).

AbdEllatif et al. (2018) showed Mean value of gestational sac at 9week in group (Ongoing pregnancy) was 3.89 ± 0.79 compared to 2.63 ± 0.45 in group (Fetal loss). There was statistically significant difference between 2 groups regarding gestational sac at 9week.

Varsha et al. (2013) showed that at the 5th week of pregnancy, the average sac (gestational sac) diameter (MSD) in Group A (normal pregnancy outcome) patients has been 5mm. The gestational sac was first visible at 4 weeks and 5 days of menstruation. MSD increased in size at a rate of 1.11 mm per day, which corresponded to the gestational age. At a p value of 0.01 levels, MSD's correlation coefficient (r) with MA was 1. MSD and MA have a positive relationship. At the initial assessment in the fifth week of pregnancy, the mean sac diameter (MSD) in Group B (abnormal outcome) was 4mm. The gestational sac was visible for the first time at 5 weeks and 1 day of menstruation. It grew gradually in size at 1.06 mm/day until the 10th week of gestation, when it could no longer be seen because the pregnancy has been terminated due to an abnormal pregnancy.

Ghali et al. (2020) showed that there is a significant difference between the studied groups regarding gestational sac diameters in the 8 th week while there is no statistically significant difference between the studied groups regarding gestational sac diameters in the 7th or 6th week

In this study we cleared that mean value of yolk sac at 6 week in Group 1 was 3.17 ± 0.52 compared to 2.42 ± 0.41 in Group 2. At 6 weeks, there was a statistically significant difference among groups 1 and 2 in terms of yolk sac (p. value 0.000).

In this study we found that Mean value of yolk sac at 10 week in group 1 was compared to 5.08 ± 0.70 in group 2. At 10 weeks, the difference between groups 1 and 2 in terms of yolk sac was statistically significant (p. value 0.000).

AbdEllatif et al. (2018) showed the relation between yolk sac diameter at different gestational age period and its relation to the outcome of pregnancy, at 6 weeks, the yolk sac diameter of the fetal loss group was found to be significantly larger than that of the ongoing pregnancy group ($P < 0.05$), while there were no significant differences between the two groups at 9 and 12 weeks ($P > 0.05$). He showed mean value of yolk sac at 9 week in group (Ongoing pregnancy) was 5.84 ± 0.61 compared to 6.09 ± 0.74 in group (Fetal loss). There was statistically significant difference between 2 groups regarding yolk sac at 10 week (p. value 0.000).

Ghali et al. (2020) showed no significant differences in yolk sac diameters across the groups studied in the 8 th week and there is no statistically significant difference between the studied groups regarding yolk sac diameters in the 7th or 6th week.

Farag et al. (2018) reported that an abnormally sized YSD was the weakest predictor of spontaneous abortion in the presence of normal GSD, CRL, and FHR measurement, and demonstrated that normal YSD did not reduce the risk of abortion. Also in agreement with a study by **Suguna and Sukanya (2019)** who reported that yolk sac diameter alone is a weaker indicator of pregnancy outcome.

In this study we demonstrated that mean value of embryonic heart rate at 6 week in group 1 was 122.29 ± 10.33 compared to 108.00 ± 14.10 in group 2. At 6 weeks, the difference in embryonic heart rates between groups 1 and 2 was statistically significant (p. value 0.000).

Our findings showed that Mean value of embryonic heart rate at 10 week in group 1 was 142.09 ± 6.63 compared to 116.36 ± 9.59 in group 2. The difference in embryonic heart rate between groups 1 and 2 at 10 weeks was not statistically significant (p. value 0.000).

AbdEllatif et al. (2018) showed relation between Heart rate at different gestational age period and its relation to the outcome of pregnancy. The fetal loss group had a significantly higher heart rate than the ongoing pregnancy group at 6 weeks ($P < 0.05$), while no significant difference among the two groups at 9 and 12 weeks ($P > 0.05$).

AbdEllatif et al. (2018) showed Mean value of embryonic heart rate at 6 week in group Ongoing pregnancy was 133.86 ± 25.64 compared to 140.40 ± 28.84 in group Fetal loss. The embryonic heart rate did not differ statistically significantly between groups 1 and 2 at 10 weeks (p. value 0.000).

According to **Ibrahim et al. (2018)**, there was a statistically significant difference among Group I and the other two groups in terms of FHR and CRL, but no significant difference in terms of GSD or YSD among the three groups (table 2).

Our results illustrated that It was 96.90 % in sensitivity, 100 % in specificity, 100% in PPV and 73.3% in NPV of embryonic heart rate at 10 weeks. It was 83.21% in sensitivity, 71.43 % in specificity, 96.5% in PPV and 31.2% in NPV of embryonic heart rate at 6 weeks.

AbdEllatif et al. (2018) showed cut off value of heart rate at 6 and 9 weeks, and the sensitivity, specificity and accuracy to predict the outcome of pregnancy at this cut off value. The cut off value of heart rate at 6 weeks was more than 135, the sensitivity was 55%, specificity was 60% and accuracy was 56.8%. At 9 weeks, the cut off value was more than 157, the sensitivity was 32%, specificity was 25% and the accuracy was 28%.

In this thesis we showed that It was 72.87% in sensitivity, 81.82 % in specificity, 97.9% in PPV and 73.10% in NPV of gestational sac at 10 weeks. It was 61.83 % in sensitivity, 85.71 % in specificity, 97.6% in PPV and 64.14% in NPV of gestational sac at 6 weeks.

AbdEllatif et al. (2018) showed the cut off value of gestational sac diameter at 6 and 9 weeks, and the sensitivity, specificity and accuracy to predict the outcome of pregnancy at this cut off value, the cut off value of gestational sac diameter at 6 weeks was 1.92, below this value the loss of pregnancy was 85.0% the more than this value the complete of pregnancy was 78.0%. At 9 weeks, the cut off value was 3.11, the sensitivity was 90.0%, specificity was 93.0% and the accuracy was 91.0%.

In this study we cleared that it was 98.45 % in sensitivity, 100 % in specificity, 100% in PPV and 84.6% in NPV of yolk sac at 10 weeks. It was 76.34 % in sensitivity, 85.71 % in specificity, 98.0% in PPV and 27.9% in NPV of yolk sac at 6 weeks.

AbdEllatif et al. (2018) showed cut off value of yolk sac diameter at 6 and 9 weeks, and the sensitivity, specificity and accuracy to predict the outcome of pregnancy at this cut off value. The cut off value of yolk sac diameter at 6 weeks was more than 4.6, the sensitivity was 81.0%, specificity was 75% and accuracy was 77%. At 9 weeks, the cut off value was more than 5.3, the sensitivity was 32%, specificity was 28% and the accuracy was 30%.

Lebda et al. (2019) showed that YSD had 97.6% sensitivity and 100% specificity in prediction of miscarriage with total accuracy of 98.1%. EHR had a sensitivity of 97.5% & specificity of 100% in the prediction of first trimester pregnancy outcome, with a total accuracy of 98.1%.

Ghali et al. (2020) showed that the combination of YSD and GA had a predictive value for pregnancy outcome (area under the ROC curve: 0.616) with a sensitivity of 96.8 % and a specificity of 50.0%.

In this study we showed that it was 100% in sensitivity, 96.90 % in specificity, 73.3% in PPV and 100% in NPV of fetal heart rate at 10 weeks. It was 71.43% in sensitivity, 83.21 % in specificity, 31.3% in PPV and 96.5% in NPV of fetal heart rate at 6 weeks.

AbdEllatif et al. (2018) showed cut off value of heart rate at 6 and 9 weeks, and the sensitivity, specificity and accuracy to predict the outcome of pregnancy at this cut off value. The cut off value of heart rate at 6 weeks was more than 135, the sensitivity was 55%, specificity was 60% and accuracy was 56.8%. At 9 weeks, the cut off value was more than 157, the sensitivity was 32%, specificity was 25% and the accuracy was 28%.

Our results revealed that It was 81.82% in sensitivity, 72.87 % in specificity, 20.5% in PPV and 97.9% in NPV of gestational sac at 10 weeks. It was 85.71% in sensitivity, 61.83 % in specificity, 19.4% in PPV and 97.6% in NPV of gestational sac at 6 weeks.

In this study we showed that It was 100% in sensitivity, 98.45 % in specificity, 84.6% in PPV and 100% in NPV of yolk sac at 10 weeks. It was 85.71% in sensitivity, 76.34 % in specificity, 27.9% in PPV and 98.0% in NPV of yolk sac at 6 weeks.

Sheiket al. (2020) showed that the sensitivity was more i.e. 66.67% for 8 weeks - 8 weeks 6 days group and 10 weeks - 10 weeks 6 days group. The sensitivity and PPV was not good for 7 weeks - 7 weeks 6 days group. The specificity was high in 9 weeks - 9 weeks 6 days group which was 95.08%. Among all gestational age groups, the sensitivity, specificity, PPV and NPV was high for 8 weeks - 8 weeks 6 days group which shows that YSD is more valuable tool in predicting pregnancy outcome in this particular gestational age group. In overall, YSD has good NPV i.e. 91.54% but poor PPV. The overall sensitivity and specificity of YSD was 50% and 83.64% in this study.

The limitation of this study was a small number of the cases and difficulty of follow up the cases; which may be due to no dedicated early pregnancy assessment clinic. So, we recommend establishment of this clinic.

Conclusion

In conclusion, ultrasound measurement of these parameters (FHR, YS diameter and shape, and GS diameter) in the first trimester showed to be a significant, useful, and noninvasive tool in the research, diagnosis, and follow-up of pregnant women in their early pregnancy. Measurement of gestational sac diameter and fetal heart rate in combination provides better prediction of the prognosis of the first trimester than when either parameter used alone. It was found in this study that the important the ultrasonographic finding of a small for date, small gestational sac diameter and fetal bradycardia suggest poor prognosis for the outcome of the first trimester.

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