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THE CORRELATION OF SHAPE OF YOLK SAC WITH SPONTANEOUS ABORTION- AN ULTRASONOGRAPHIC STUDY

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ABSTRACT

The pregnancy is one of the most fascinating experiences which a woman undergoes in her life and of the whole, the first trimester is a vital time as the pregnancy gets established. The last menstrual period (LMP) is generally used as a landmark for pregnancy dating, and the first trimester of pregnancy is defined as 12 weeks after the LMP. The first recognizable structure inside the gestational sac is the yolk sac, which should be detectable as a regularly rounded extra-amniotic structure when the gestational sac reaches dimensions of 8 to 10 mm. In a normal pregnancy it should be possible to observe the yolk sac between 6-12 weeks of pregnancy or when it reaches 10 mm in size. Ultrasonography shows the yolk sac as a round structure that is made up of an anechoic center bordered by a regular well-defined echogenic rim. The normal shape of yolk sac is circular. The yolk sac appears at 6 weeks, thereafter increases in size, attains its maximum diameter at 10 weeks and then it starts decreasing in size. It disappears at 12 weeks.

Aim and Objectives of the present study is to study the shape of yolk sac in pregnant females, in the first trimester of pregnancy and to find it's correlation with spontaneous abortion.

We studied 72 pregnant females, who were in their first trimester of pregnancy, referred by Department of Obstetrics and Gynaecology. The shape of yolk sac was observed by transvaginal sonography and its correlation with spontaneous abortion was studied.

Yolk sac was present in 70 cases (97.22%) and in two cases (2.78%), it was absent. In 68 (97.14%) cases the shape of yolk sack was circular. It was irregular (1.4%) and oblong (1.4%) in one case each.

KEYWORDS: Yolk sac, Pregnancy, Yolk sac shape, Transvaginal sonography, Spontaneous abortion.

INTRODUCTION

The pregnancy is one of the most fascinating experiences which a woman undergoes in her life and of the whole, the first trimester is a vital time as the pregnancy gets established. The last menstrual period (LMP) is generally used as a landmark for pregnancy dating, and the first trimester of pregnancy is defined as 12 weeks after the LMP (1). The first recognizable structure inside the gestational sac is the yolk sac, which should be detectable as a regularly rounded extra-amniotic structure when the gestational sac reaches dimensions of 8 to 10 mm. The yolk sac provides nutritional, metabolic, endocrine, immunologic and hematopoietic functions during organogenesis in embryonic life and is considered to reach its highest level of functional activity between the 4th and 7th week of embryonic development. Yolk sac is a critical landmark that identifies a true gestational sac (2). Ultrasonography shows the yolk sac as a round structure that is made up of an anechoic center bordered by a regular well-defined echogenic rim (3). The diameter of a yolk sac is usually 3-4 mm and increases in size up to the 10th week of gestation and attains it maximum diameter at 10 weeks after which it's size starts becoming smaller and it disappears at 12 weeks (4-5).

The appearance of the yolk sac is of significant clinical use in the evaluation of early pregnancy, therefore its presence should routinely precede visualization of the embryo (6). The yolk sac was detected earlier than cardiac activity (presumably identifying a living embryo) in all cases. The other studies, which sonographically evaluated both normal and abnormal intrauterine pregnancies abdominally and transvaginally, detected a yolk sac in all normal and in some abnormal pregnancies (7). However, when the yolk sac is not identified earlier than identification of the embryo, this is always associated with spontaneous abortion. Transvaginal sonographic diagnosis of a blighted ovum is certain when the mean gestational sac diameter exceeds 8 mm without a yolk sac or when the

mean gestational sac diameter exceeds 16 mm without an embryo. The threatened and spontaneous abortions together present the most common complications of early pregnancy. In 50% of the cases, the woman is unaware of the fact that she was pregnant and she has aborted. Thirty to forty percent of pregnancies fail after implantation, and only ten to fifteen percent manifest with clinical symptoms (8). So, far as yolk sac is concerned, its abnormal shape is also correlated with spontaneous abortion (9). But the studies on yolk sac shape yields a conflicting results. Some studies suggest that irregular yolk sac shape is associated with poor pregnancy outcome (10). In contrast, some authors claims that a pregnancy can have a completely normal course even in the presence of abnormal shape of the yolk sac. Therefore, its effects on gestational outcome requires further investigation. Thus, the purpose of the present study is to study the shape of yolk sac and correlate it with spontaneous abortion.

AIMS AND OBJECTIVES: of the present study is to study the shape of yolk sac in pregnant females, in the first trimester of pregnancy, to find it's correlation with spontaneous abortion and to compare the results with those of previous studies.

MATERIAL AND METHODS

We performed our study on 72 patients in the Department of Anatomy in collaboration with Department of Radiology & Department of Obstetrics and Gynaecology at Era's Lucknow Medical College and Hospital, Lucknow, India. All pregnant women in their first trimester of pregnancy referred by Department of Obstetrics for transvaginal sonography were recruited for the study on the basis of inclusion/exclusion criteria. For the present study, clearance was obtained from the ethical committee of the Institution.

Inclusion Criteria: Uncomplicated, singleton pregnancy belonging to gestational age between 6-12 Weeks.

Exclusion Criteria

- Women with structural anomalies of uterus and cervix.
- Women with known medical disorders causing abnormal pregnancy outcome i.e. patients with Anemia, Hyperthyroidism, Diabetes mellitus, Chronic hypertension.
- Women who had irregular menstrual cycles.
- Molar pregnancy
- Patients refusing for transvaginal sonography
- Patients who were unwilling for follow up.

The characteristics for the **normal** and **abnormal** yolk sac were (16):

Normal

- Diameter between 2-5 mm
- Circular shape
- The presence of an echogenic rim and hypo-echoic center.

Abnormal

- Yolk sacs that had diameters smaller than 2 mm or larger than 5 mm
- Were not circular (i.e. irregular or oval),
- Hyper or hypoechoic rim or hyperechoic center.

Detailed history was taken to rule out medical and surgical illnesses which could affect our study. Thorough general and physical examination was done. Informed consent was taken for the performance of transvaginal scan from all study subjects. The machine used was LOGIQ PRO5 by GE Healthcare, using a high frequency 7-12MHz TVS probe. The procedure was explained in detail to the patient and consent was taken. The endovaginal transducer was covered with a sterile condom lubricated with gel before insertion. The patient was placed in the lithotomy position with a slight reversed trendelenburg tilt. The patient was asked to relax the pelvic muscles. The transducer was inserted approximately 6-8 cm into the vagina. Scanning was done in both coronal and sagittal planes. A systematic approach was used for performing TVS. First the uterus was scanned, then the adnexa, and finally the cul-de sac. The gestational sac was looked for the presence of yolk sac and its shape. Yolk sac shape was observed. The yolk sac with wrinkled margins, indented walls, or both was defined as having an irregular shape. The yolk sac which had oblong shape instead of circular were also considered abnormal. The patients were followed till 20 weeks of gestation, to observe whether pregnancy continued beyond this period or resulted in spontaneous abortion.

Statistical analysis

The study parameters include age, parity, shape, diameter and appearance of yolk sac on sonography. The collected data were analyzed by usual methods of statistical analysis using SPSS 20.0 (SPSS Inc., Chicago, IL) software package. Results were expressed as mean ± standard deviation or percentage; where appropriate. Student t test was used in numerical value between two groups. Spearman correlation test, chi square test and Fisher's exact test were utilized to detect the correlations between the variables whereas the odds ratios and corresponding 95% confidence intervals were used to estimate miscarriage risks. Two tailed $p < 0.05$ were accepted to be statistically significant (19).

RESULTS

Out of 72 cases, yolk sac was seen in 70 cases (97.22%) and it was absent in two cases (2.78%). The shape of the yolk sac was circular in 68 (97.14%) cases. It was irregular (1.4%) and oblong (1.4%) in one case each. Out of 70 cases in which yolk sac was present, the gestation advanced only in 61 cases. In 9 cases, it terminated into abortion. Among these 9 cases, yolk sac was circular in 7 cases, whereas it was oblong and irregular in one case each, p-value is highly significant ($p<0.001$) showing that yolk sac shape has significant correlation with spontaneous abortion. In cases where maternal age was <= 25years, yolk sac was circular in 21 cases and no case of irregular and oblong yolk sac were seen ,whereas in the age range of 26 – 30 years, circular yolk sac was present in 40 cases, irregular and oblong in 1 case each. In the age group of 31 – 35 years only circular shape was observed in 7 cases. The p-value is 0.932, which is non- significant showing that the maternal age has no effect on the shape of yolk sac.

Yolk sac shape	Frequency(n)	Percent
Circular	68	97.14
Irregular	1	1.4
Oblong	1	1.4
Total	70	100.0

Table 1: Showing Frequency Of Different Yolk Sac Shapes

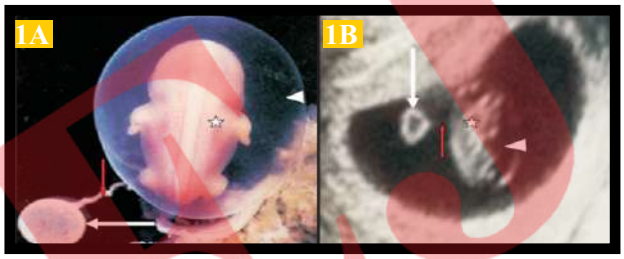
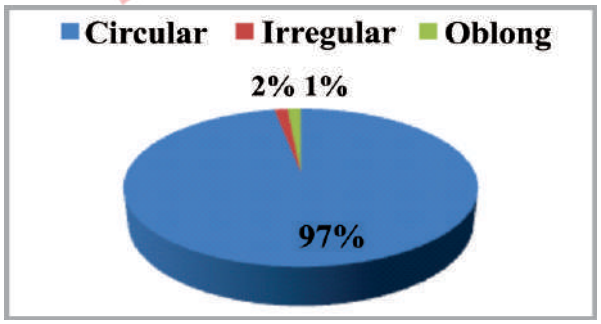


Fig (1A): Showing Yolk Sac (White Arrow), Vitelline Duct (Red Arrow), Amniotic Cavity (arrow Head) And Embryo (star) And Fig (1B) Is The Sonographic Appearance Of Yolk Sac, Vitelline Duct (red Arrow), Amniotic Cavity (arrow Head) And Embryo (star) (white Arrow).



Graph 1: Showing Distribution Of Different Yolk Sac Shapes

Fig 2: Showing A Normal Yolk Sac On Sonography.

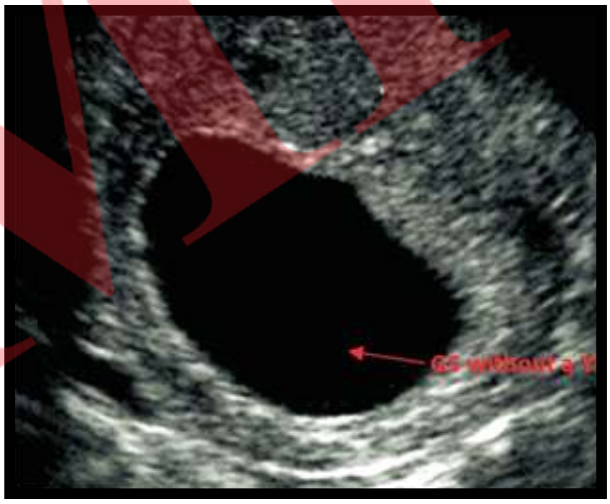


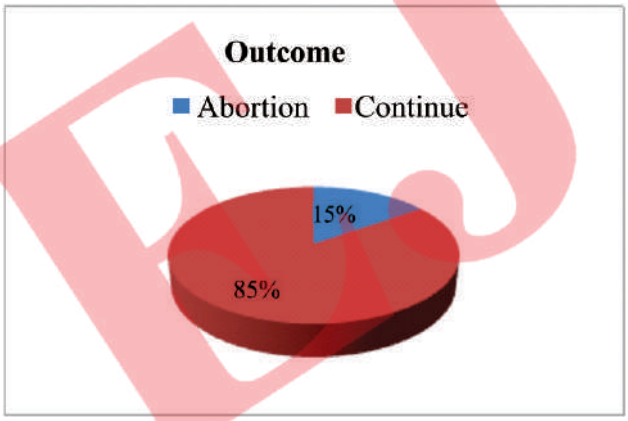
Fig 3: Showing Sonographic Appearance Of An Empty Gestational Sac.

Fig 4: Showing Sonographic Picture Of An Irregular Yolk Sac (white Arrow).

Fig 4: Showing Ultrasonographic Appearance Of Oblong Yolk Sac.

Outcome	Frequency(n)	Percentage(%)
Abortion	11	15.3
Continued beyond 20 weeks	61	84.7
Total	72	100.0

Table 2: Showing Frequency Of Various Pregnancy Outcomes



Graph 2: Showing Frequency Of Pregnancy Outcome

Yolk sac shape	Outcome		Total	p value
	Abortion	Continued beyond 20 weeks		
Circular	7	61	68	<0.001
Irregular	1	0	1	
Oblong	1	0	1	
Total	**9**	**61**	**70**	

Table 3: Showing Correlation Of Yolk Sac Shape With Pregnancy Outcome

Age categories (Years)	Yolk sac shape			Total	p value
	Circular	Irregular	Oblong		
<= 25	21	0	0	21	0.932
26 –30	40	1	1	42	
31 –35	7	0	0	7	
Total	**68**	**1**	**1**	**70**	

Table 4: Shows Distribution Of Yolk Sac Shape According To Maternal Age.

DISCUSSION

Transvaginal sonography (TVS) is rapidly becoming the diagnostic procedure of choice when the patient has to be evaluated in very early pregnancy. Previous reports have shown that TVS can identify early pregnancy, and can correlate certain growth parameters of the pregnancy with the menstrual history (11). The cases in which the yolk sac was not identified earlier than identification of the embryo or abnormal yolk sac shape visualized at initial sonography, was always associated with a poor pregnancy outcome (12). In the present study, the yolk sac was not visualized in 2.78% of the cases. In studies carried by Xie YJ et al (13), non visualization of yolk sac was reported in 0.67% cases, which is much lower than what has been seen in the present study. While in the studies done by Heller R et al (14), Jose L et al (15), Moradan S et al (16) and Shetty AS et al (17) different percentages of non-visualization of the yolk sac were found as 11%, 20.3%, 4.54% and 4.3% respectively which were much higher than the findings of present study. In the present study all cases showing absence of yolk sac resulted in abortion.

Similar findings were reported by Heller R et al (14), Jose L et al (15) and Sanam Moradan et al (16) and Nawal R et al (18). Thus, these studies strongly support the findings of the present study, that a yolk sac should always be present in normal pregnancies.

Contrary to the present study, Kurtz AB et al (2) and Shetty AS et al (17) depicted the fact that detection of the yolk sac is not an early predictor of pregnancy outcome and they concluded that the absence of the yolk sac was not consistently predictive of a spontaneous abortion. In the present study all cases with absent yolk sac ended up in abortion, while in the study done by Shetty AS et al (17), only 75% of the cases with absent yolk sac ended in spontaneous abortions.

In the present study, 2.85% of cases were found to have abnormal yolk sac shape. As reported by Tan S et al (10) and Shetty AS et al (17) 17% and 7.7% of the cases had yolk sac with an abnormal (irregular) shape respectively. Among 9 cases of abortions in the present study, in 22.22% cases, abnormal shape of the yolk sac

was observed. It was oblong and irregular in 11.11% case each. In a study carried by Tan S et al (10), abnormal yolk sac shape was responsible for 16.66% of abortions, showing that yolk sac shape does effect the pregnancy outcome. A higher percentage of miscarriages due to abnormal shape (63.63%) were reported by Shetty AS et al (19). The present study attempted to determine the normal range and abnormalities of yolk sac shape, size and appearance and their correlation with GSD, GA, CRL and pregnancy outcome. Among 9 cases of abnormal yolk sac, it was circular in 7 cases, oblong and irregular in one case each. A highly significant correlation was observed between yolk sac shape and spontaneous abortion. Correlation between yolk sac shape and maternal age (years) was found to be non-significant.

CONCLUSION

Out of 72 cases, yolk sac was seen in 70 cases (97.22%) and in two cases (2.78%), it was absent. Both the cases in which yolk sac was absent, terminated into spontaneous abortion. Among 70 cases in which yolk sac was present, 9 cases culminated into abortion. So, total 11 (9 out of 70 cases with yolk sac present and 2 with absent yolk sac) cases terminated into spontaneous abortion. Out of 70 cases in which yolk sac was present, in 68 (97.14%) cases the shape of yolk sac was circular and it was oblong and irregular in one case (1.4%) each. Out of 11 cases of abortion, in 2 cases (18.18%) the yolk sac was not visualized and in rest 9 cases (81.82%), yolk sac was abnormal i.e had either irregular or oblong shape or was enlarged or small in size. Among these 9 cases of abnormal yolk sac, it was circular in 7 cases, oblong and irregular in one case each. A highly significant correlation was observed between yolk sac shape and spontaneous abortion. Correlation between yolk sac shape and maternal age (years) was found to be non-significant. Abnormalities of the yolk sac shape or absence can be used as good predictive indicators of early pregnancy loss, even before morphology of fetus can be studied sonographically. Thus, these parameters may play important role in clinical practice to predict whether the pregnancy will continue normally or it may result into spontaneous abortion.

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