ORIGINAL ARTICLE

TO ASSESS VALUE OF YOLK SAC IN PREDICTING PREGNANCY OUTCOME DURING FIRST TRIMESTER: OBSERVATIONAL STUDY

Nawal Rajani[1], Khuteta Sushila[2], Jain Deepika[1], Khuteta Rakesh P[2], Meena Vinay K[3]

[1]Senior resident 2Professor & Unit Head, Department of Obstetrics and Gynaecology Mahila Chikitsalaya S.M.S. Medical College, Jaipur (Rajasthan) [3] Resident, Department of Medicine, IMS BHU, Varanasi, Uttarpradesh

Correspondence:
Dr. Rajani Nawal, Email: rajaninawal008@gmail.com

ABSTRACT

Objective: To find out normal size and shape of yolk sac in pregnancies between 5-12 weeks of gestation, its association with pregnancy outcome and correlation of various fetal parameters with mean yolk sac diameter.

Method: 95 pregnant women of 20-30 years age group with amenorrhoea 1 month 5 days to 7 days selected randomly for this study from August 2009 to October 2010, underwent TVS fortnightly from 5-11 weeks of gestation and at 12 weeks either of the TVS or TAS to visualize changes in mean yolk sac diameter (MYSD) and yolk sac (YS) shape and pregnancy outcomes. Results analyzed by Z-test and correlation coefficient found out between various parameters.

Results: In Pregnancies with normal outcome (n=72), MYSD was progressively increased from 3.17 mm at 5-5.2 weeks of GA to 5.03 mm at 9-9.2 weeks of GA. At 11 weeks YS either disappeared (73.61%) or MYSD decreased (26.38%) with round & regular shape. Highly significant difference with p value <0.001, was detected between MYSD of pregnancy with normal outcome and missed abortion (n=19). Four cases of missed abortion had irregular shaped YS. In anembryonic pregnancies YS was not seen. Highly significant (p value <0.001)correlation was found between MYSD and GA by LMP (r=+0.740),MYSD and MGSD (r =+0.739) and significant correlation was detected between MYSD and CRL (r =+0.355), p value <0.005.

Conclusions: 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.

Keywords: Pregnency, yolk sac, fetus, TVS, missed abortion

INTRODUCTION

Accurate differentiation between normal pregnancy and pregnancy loss in early gestation remains a clinical challenge[1].It is estimated that approximately 30-40% of implanted pregnancies results in spontaneous abortion during first trimester[2,3].

In first trimester yolk sac is the primary source of exchange between mother and fetus, before placental circulation is established[3]. It has haematopoitic, metabolic, secretory, excretory, immunogenic function[3]

The primary YS form at approximately 24 days of menstrual age. As the extraembryoniccelom forms, the primary YS is pinched off and the secondary YS is formed at 27-28 days of menstrual age, which is the first embryonic structure visualized in gestational sac sonographically[3]. In normal pregnancies it is identified by the MGSD of 5 mm at transvaginalsonography.

Gross changes in its morphology, therefore could indicate significant dysfunction of this maternofetal transport system and may be indicator of impending embryonic demise[3]

In this study we have tried to find out whether morphological details of yolk sac obtained by TVS can be used to predict pregnancy outcome for care of pregnant women.

MATERIALS AND METHOD

The study protocol was approved by the research review board of our institute and informed written consent was taken from all the participants.

This was an observational study conducted in Department of Obstetrics & Gynecology SMS Medical College Jaipur from August 2009 to Octo. 2010. Predecided 100 consecutive samples selected by

convenience sampling were included in the study, out of which 5 were lost to follow up. Pregnant women of 20-30 years of age group, amenorrhoea one month 5 days to 7 days, selected from OPD. Pregnant women with multifetal gestation, diabetes mellitus, hypertention, smoking and drug users were excluded from the study. Gestational age was calculated from the reliable menstrual history dates and early sonographic measurement of MGSD and CRL. Mean of inner to inner yolk sac diameter was calculated and yolk sac shape was observed. All patients were followed fortnightly by TVS upto 11 weeks of gestation and at 12 weeks of gestation either by TAS or TVS to visualize changes in the above mentioned parameters.

Abnormal yolk sac size was defined as >2 SD above or below the MYSD for particular gestational age.Abnormal shape refers to any substantial change from normal rounded regular outline. The pregnancy outcome is normal if pregnancy is carried 12 completed weeks of gestation.

Results were analyzed by Z-test and correlation coefficient was found out between various parameters

RESULTS

One hundered women were enrolled but as five cases were lost on follow up, ninety five women constituted our study. During the follow-up pregnancies that continued beyond 12 weeks were considered as normal outcome (n=72) and pregnancies that discontinued were regarded as abnormal outcome , which was consisted of missed abortion (n=19) and blighted ovum (n=4).

As shown in Table 1, mean value of MYSD at increasing gestational age together with the range of ±2SD. The MYSD increases from 3.17 mm at 5-5.2 weeks of gestation to 5.03 mm at 9-9.2 weeks of gestation and at 11-11.2 weeks of gestation MYSD either decrease in size (26.38%) or disappeared (73.61%).The maximum MYSD found in pregnancies with normal outcome was 5.5mm.

Table 1: **Mean yolk sac diameter at particular gestational age in pregnancy with normal outcome**

Gestational Age (weeks)	Mean yolk sac diameter (mm)	2SD	Range (mm)
5-5.2	3.17(n=71)	0.76	2.41 - 3.93
7-7.2	4.05 (n=72)	0.96	3.09 - 5.01
9-9.2	5.03 (n=72)	0.74	4.29 – 5.77
11-11.2	4.32 (n=19)	0.94	3.38 – 5.26

Table 2: Mean yolk sac diameter at particular gestational age in pregnancy with missed abortion

Gestational Age (weeks)	Mean yolk sac diameter (mm)
5-5.2	4.45 (n=18)
7-7.2	5.06 (n=19)
9-9.2	6.11 (n=14)
11-11.2	6.40 (n=1)

Table 2 showing that (a) mean value of MYSD increased from 4.33 mm at 5-5.2 weeks of gestation to 6.1 mm at 9-9.2 weeks in cases with missed abortion. Maximum MYSD found was 6.8 mm. When confidence interval for MYSD of pregnancy with normal outcome was calculated, mean values of MYSD were higher in cases of missed abortion at particular gestational age and early disappearance of yolk sac as compared to pregnancy with normal outcome. Largest MYSD found in cases of missed abortion was 6.8 mm. (b)Out of 19 cases of missed abortion thirteen cases had MYSD above 95% CI and two cases had MYSD below 5% CI from the mean value calculated for pregnancy with normal outcome, with round and regular shape. Four cases had irregular yolk sac shape ,out of them two cases had MYSD with in 5%-95% CI and one case had MYSD below 5%CI and one had above 95% CI.

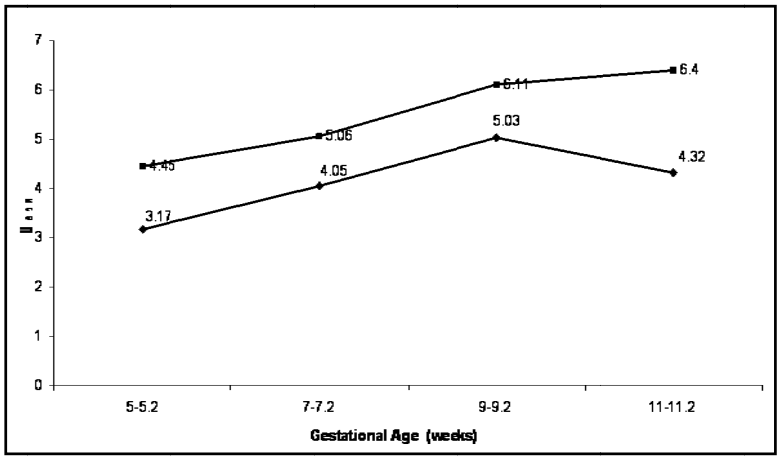

Fig. 1: Comparison of mean yolk sac diameter at particular gestational age between pregnancy with normal outcome and missed abortion

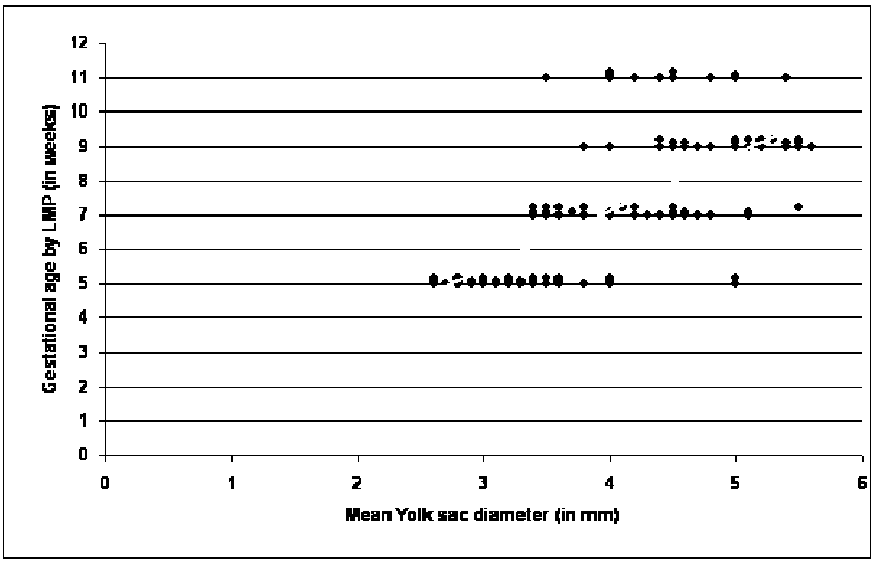

Fig. 2: Correlation between Mean Yolk sac diameter and Gestational age by LMP

Table 3 depicting that, when the MYSD of two groups (normal outcome and missed abortion) evaluated, a highly significance difference (p=<.001) at every visit was detected between MYSD of both groups. In cases of blighted ovum neither the fetal pole nor yolk sac seen.

Table 3: Comparison of mean yolk sac diameter at particular gestational age between pregnancy with normal outcome and missed abortion

Gestational Age (weeks)	Mean yolk sac diameter (mean ±2 SD)		p value
	Normal Outcome	Missed Abortion	
5-5.2	3.17 ± 0.76	4.45	< 0.001
7-7.2	4.05 ± 0.96	5.06	< 0.001
9-9.2	5.03 ± 0.74	6.11	< 0.001
11-11.2	4.32 ± 0.94	6.40	

Table 4 shows that out of 87 cases with round and regular yolk sac shape, 72 cases(82.75%) had normal outcome and 15 cases (17.24%) had missed abortion.4 patients had irregular shaped yolk sac and all four were diagnosed as missed abortion on follow up.

Table 4: Distribution of cases according to yolk sac shape and pregnancy outcome

Yolk sac shape	Pregnancy outcome		Total
	Normal Outcome	Missed Abortion	
Regular	72	15	87
Irregular	0	4	4
Total	72	19	91

Out of these 4 cases, 2 cases had MYSD within 5%-95% confidence interval from mean value in pregnancy with normal outcome. 2 cases had MYSD outside 5%-95% confidence interval. No case with normal outcome had irregular shaped yolk sac.

Table 5 showing highly significant correlation was found between MYSD and gestational age by LMP (r =+0.740), MYSD and MGSD (r +0.739) with p-value < 0.001 and significant correlation (r=+ 0.355) was detected between MYSD and CRL (p-value <0.05).

Table 5: Correlation of MYSD with Gestational Age, MGSD and Crown Rump Length in cases with normal outcome

Correlation	r-value	P-value
Mean Yolk sac diameter v/s Gestational age by LMP	+ 0.740	< .001
Mean Yolk sac diameter v/s Mean Gestational sac diameter	+ 0.739	< .001
Mean Yolk sac diameter v/s CRL	+ 0.355	< .05

DISCUSSION

In our study, progressively increased MYSD was found with advanced gestational age between 5-9 weeks of gestational age, followed by either disappearance (73.61%) or decreased size (26.38%) thereafter at 11 weeks of GA in cases with normal outcome and shape was round and regular at all visits.

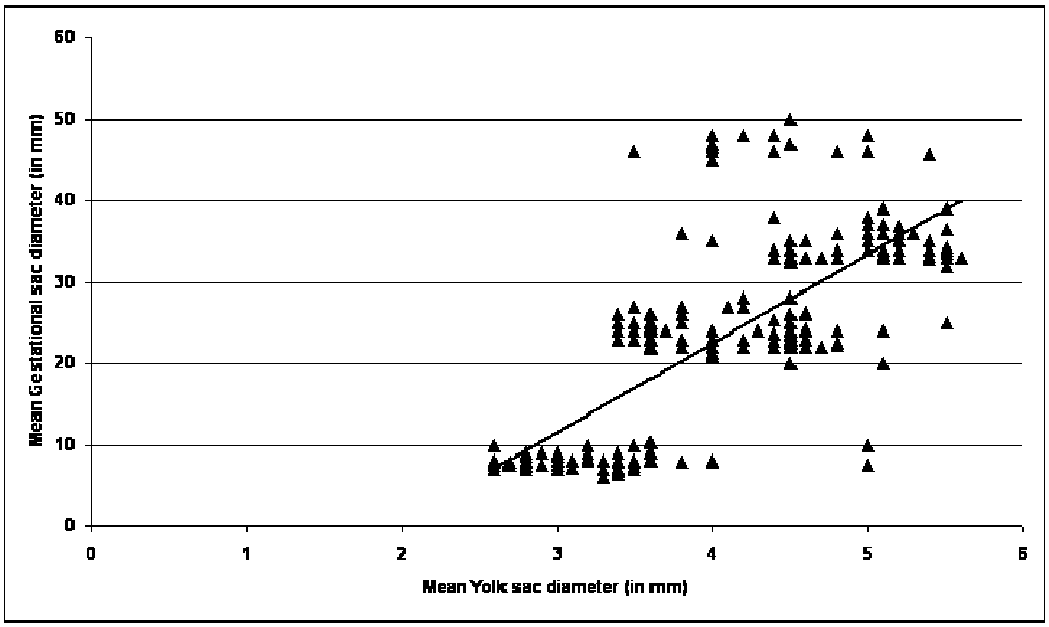

Fig. 3: Graph showing correlation between MYSD and Mean Gestational sac Diameter

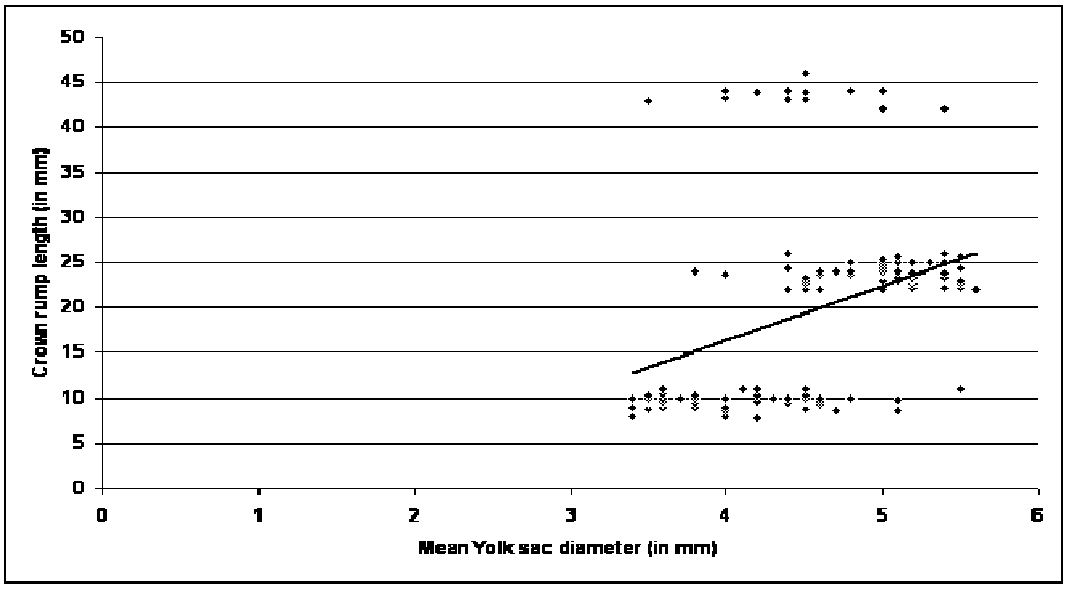

Fig. 4: Graph showing the Correlation between Mean Yolk sac diameter and Crown ramp length

Cepni et al.[1] demonstrated the steady increase in yolk sac diameter from 5 to 11 weeks of gestation in normal pregnancies after which it disappears by 12 weeks.Chama et al.2 reported linear increament in MYSD from 2.27 mm at 5 weeks of gestation to 5.61 mm at 11 weeks of gestation. Lindsay et al [3] reported that yolk sac grows at a rate of approximated 0.1mm per mm growth of mean gestational sac diameter when the mean gestational sac diameter is less than 15mm and then slows to 0.03mm per mm growth of MGSD. The upper limit of normal yolk sac diameter between 5-10 weeks of menstrual age is 5.6 mm.

Fig 5: Yolk sac is the first structure to be seen at T.V.S. even before fetal pole is seen. This patient had L.M.P. 1 month 7 days and yolk sac is seen with MYSD 3.4 mm.

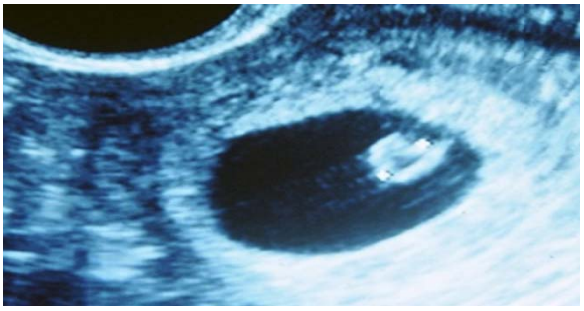

Fig 6: This patient had 1 month 18 days ammenorhoea showing, small and irregular YS on TVS. Aborted on follow up

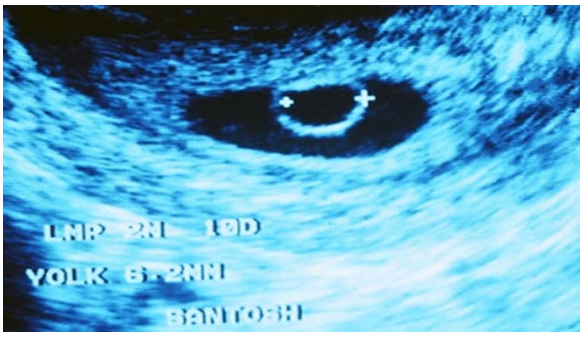

Fig 7: This patient had 2 months 10 days ammenorhoea with large MYSD. No foetal pole appeared

Fig 8: This patient had ammenorhoea 2 months 20 days, neither showing YS nor foetal pole (anembryonic pregnancy)

CHO et al [4] showed in normal pregnancies with embryonic heart beats a deformed or absent yolk sac never detected. The largest yolk sac in viable pregnancies was 8.1 mm. In cases of missed abortions with prior existing embryonic heartbeats, a relatively large a progressively regressing, a relatively small and a deformed yolk sac(irregular shape, echogenic spot or band) was found.

In anembryonic gestations absent, irregular shaped and relatively large yolk sac was found.

Lindsay et al [3] reported no pregnancy with normal outcome had a yolk sac diameter of greater than 5.6mm at less than 10 weeks of MA. In six patients, the YSD was more than 5.6mm. All six had abnormal outcome. Of seven patients with abnormal yolk sac shape at initial sonography, three had abnormal yolk sac shape at follow up and all three had abnormal outcome.

Kucuk et al. [4] found a yolk sac diameter out of two standard deviations of the mean for the menstrual age allowed prediction of an abnormal pregnancy outcome with a sensitivity of 65 %,a specificity of 97 %, a positive predictive value of 71 %,and a negative predictive value of 95 %. An abnormal yolk sac shape allowed prediction of an abnormal pregnancy outcome with a sensitivity of 29 %, a specificity of 95 %, a positive predictive value of 47% and a negative predictive value of 90.5 %. They calculated the correlation coefficients between yolk sac and menstrual age, yolk sac and crown-rump length and between yolk sac and mean gestational yolk sac diameter as r: 0.9581 ($p < 0.001$), r: 0.9427 ($p < 0.0001$) and r: 0.8855 ($p < 0.0001$), respectively. They concluded that secondary yolk sac evaluation is a valuable tool to predict pregnancy outcome[27].

Fotios K Varelas et al.[6] showed YSD progressively increase in healthy pregnancies during the first trimester. Absence of yolk sac or even a smaller yolk sac diameter than expected for any gestational age is predictors of poor pregnancy outcome during the first 12 weeks[2].

CONCLUSION

Abnormalities of the yolk sac size or shape, early regression or absence can be used as poor predictive indicators of early pregnancy, even before fetal morphology can be studied sonographically. This concept may also be exploited to clinical practice in embryo reduction in the era of artificial reproductive techniques.

REFERENCE

1. Cepni I, Bese T, Oscal P, Budak E, Idi M, Aksu MF. Significanceof yolk sac measurements with vaginal sonography in the first trimester in the prediction of pregnancy outcome. ActaObstetriciaetGynecologicaScandinavica. 1997;76:969 – 972.
2. Chama CM, Marupa JY, Obed JY. The value of the secondary yolk sac in predicting pregnancy outcome. J ObstetGynaecol. 2005; **25**: 245–247.
3. Lindsay DJ, Lovett IS, Lyons EA, Levi CS, Zheng XH, Holt SC,et al. Yolk sac diameter and shape at endovaginalscan;predictors of pregnancy outcome in the first trimester. Radiology.1992 ; 183 : 115-118.
4. Cho Fu- Nan, Chen San-Nung, TAI Ming-Hong and YANG Tsung –Lung.Australian and New Zealand Journal of Obstetrics and Gynaecology. 2006; 46: 413-418.
5. Kucuk T, Duru NK, Yenen MC, Dede M, Ergun A, Baser I. Yolk sac size and shape as predictors of poor pregnancy outcome.Journal of Perinatal Medicine. 1999;27:316 – 320
6. Fotios K. Varelas, Nicolaos M. Prapas, Ren-Ing Liang, Ioannis M. Prapas, Georgios A. Makedos. Yolk sac size and embryonic heart rate as prognostic factorsof first trimester pregnancy outcome .European Journal of Obstetrics & Gynecology and Reproductive Biology.2008; 138:10–13.