

# Yolk Sac Diameter as a predictor of Pregnancy Outcome

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## Abstract

**Aim:** The aim of this study to evaluate the role of yolk sac diameter as a predictor of pregnancy outcome.

**Materials and Methods:** The research was conducted at the Department of Obstetrics and Gynecology, with clearance from the institute's ethical committee. 150 pregnant women of gestational age 6-10weeks were included in this study. The trial excluded patients with molar pregnancy, ectopic pregnancy, multiple gestations, uterine anomalies, women with known endocrine disorders.

**Results:** Out of total 117 cases in good outcome, 91.5% had a normal yolk sac diameter and 8.5% had an abnormal yolk sac diameter at first visit. Out of total 33 cases in poor outcome, 12.1% were found to have a normal yolk sac diameter and 87.9% were found to have an abnormal yolk sac diameter at first visit (P value <0.001). This study found that the sensitivity of normal yolk sac diameter for predicting good outcome is 91.45% and the specificity that abnormal diameter of yolk sac predicts poor outcome is 87.88%.

**Conclusion:** Greater yolk sac diameter had a poorer outcome compared to cases with normal yolk sac diameter, missed abortion being the most common adverse finding. Yolk sac shape and size assessment gives a good overview of pregnancy outcome in first trimester. Hence, it is advised that yolk sac biometry be done routinely in first trimester.

**Keywords:** yolk sac diameter, abortion

## Introduction

The yolk sac is the first extra embryonic structure that becomes sonographically visible within the gestational sac and acts as the primary route of exchange between the human embryo and the mother before the placental circulation is established. The yolk sac is a round structure that is made up of an anechoic center bordered by a regular well-defined echogenic rim. It is usually 3-5 mm in diameter. 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. First trimester is crucial, since 80% of pregnancy losses occur spontaneously during this period. Contributing factors are diverse, so there is difficulty in reliably predicting the outcome of pregnancy. There is a need for accurate method to assess the early pregnancies that allows early indication of unwanted outcomes. This can guide a tailored and pre-emptive management strategy, and aids in a much needed psychologic preparation of the expecting mother.

## Materials and Methods

The research was conducted at the Department of Obstetrics and Gynecology, with clearance from the institute's ethical committee. 150 pregnant women of gestational age 6-10weeks were included in this study. The trial excluded patients with molar pregnancy, ectopic pregnancy, multiple gestations, uterine anomalies, women with known endocrine disorders.

## Methodology

Pregnant women registering between 6-10 weeks period of gestation in OPD were recruited for the study. After a well informed consent, a detailed history was taken and examination was done for all the cases. Patient was placed in dorsal position for a Transvaginal Ultrasonography and the endovaginal transducer covered with sterile condom lubricated with gel was inserted. The transducer was inserted approximately 6-8 cm into the vagina. Scanning was done in both coronal and sagittal planes, with a systematic approach for performing TVS; first the uterus was scanned,

then the adnexa, and finally the cul-de sac. After visualization of the gestational sac and the yolk sac, the yolk sac diameter was measured by placing calipers at the margin. A yolk sac diameter of 3-5mm was considered normal. A diameter <3mm was considered as smaller, and >5mm was considered as greater. Self reporting of any complication was insured and patients were subjected to a scan at 18-20 weeks; and were followed till 20 weeks of gestation and were considered as normal pregnancy outcome if pregnancy continued beyond 20 weeks and abnormal outcome if they ended in abortion.

### Statistical Methods

For statistical analysis, the SPSS 25.0 programme was employed. Tables with mean and percentages were used to show the data. A statistically significant p-value of 0.005 was used.

### Results

**Table 1: Yolk sac diameter according to gestational age at the time of enrolment**

GA Weeks at the time of enrolment)	(Completed the time	Cases	Minimum (mm)	Maximum (mm)	Mean (mm)
6 weeks		66	4	5.5	4.933
7 weeks		43	3.8	5.6	5.147
8 weeks		28	4	5.8	5.319
9 weeks		13	4.7	6	5.575

**Table 2: Outcome according to gestational age at the time of enrollment**

GA Weeks at the time of enrolment)	(completed the time	Good outcome*		Poor Outcome#	
		Cases	Percentage	Cases	Percentage
6 weeks		54	46.2%	12	36.4%
7 weeks		35	29.9%	8	24.2%
8 weeks		19	16.2%	9	27.3%
9 weeks		9	7.7%	4	12.1%

\*'Good outcome' defined as continuation of pregnancy beyond 20 weeks of gestation

#'Poor Outcome' defined as any type of abortion (except medical or surgical) including spontaneous abortion, threatened abortion, missed abortion or fetal abnormality before 20<sup>th</sup> week of gestation

Table 2 shows that the outcome according to gestational age at the time of enrollment. Out of total 117 cases, 54 (46.2%) were found good outcome at 6 weeks followed by 35 (29.9%) at 7 weeks of gestation. At 8 weeks 19 (16.2%) and at 9 weeks 9 (7.7%) were found good outcome. Out of total 33 cases, 12 (36.4%) were found poor outcome at 6 weeks followed by 9 (27.3%) at 8 weeks of gestation. At 7 weeks 8 (24.2%) and at 9 weeks 4 (12.1%) were found poor outcome.

**Table 3: Total Cases Registered and Outcome at 20<sup>th</sup> weeks of Gestation**

Yolk Sac Diameter	Total Cases	Normal Outcome	Spontaneous Abortion	Threatened Abortion	Missed Abortion	Foetal Anomalies
Greater	36	8	2	1	25	0

Normal	101	99	0	0	2	0
Smaller	13	10	1	0	2	0
Total	150	117	3	1	29	0

Table 3 shows that total cases registered and Outcome at 20<sup>th</sup> weeks of Gestation. Out of total 36 cases in greater yolk sac diameter, 8 were found normal outcome, 2 spontaneous abortion, 1 threatened abortion and 25 were found missed abortion. Out of total 101 cases in normal yolk sac diameter, 99 cases were found normal outcome, 1 spontaneous abortion and 2 were found missed abortion. Out of total 13 cases in smaller yolk sac diameter, 10 cases were found normal outcome, 1 spontaneous abortion, 1 threatened abortion and 29 were found missed abortion.

**Table 4: Yolk sac, its shape and diameter at first visit and final follow up visit**

Yolk Sac Shape	Good outcome (n = 117)		Poor outcome (n = 33)		P value
	Cases	%	Cases	%	
Regular	101	86.3%	4	12.1%	<0.001
Irregular	16	13.7%	29	87.9%	

Out of total 117 cases in good outcome, 101 (86.3%) were found regular and 16 (13.7%) were found irregular yolk sac shape at first visit. Out of total 33 cases in poor outcome, 4 (12.1%) were found regular and 29 (87.9%) were found irregular yolk sac shape at first visit. (P value <0.001)

**Table 5: Diagnostic accuracy of Yolk sac diameter (normal/abnormal) for predicting outcome (good outcome / missed abortion)**

Statistic	Value	95% CI
Sensitivity	91.45%	84.84% to 95.83%
Specificity	87.88%	71.80% to 96.60%
Positive Predictive Value	96.40%	91.42% to 98.53%
Negative Predictive Value	74.36%	61.27% to 84.17%

Above table shows various statistical values for diagnostic accuracy of yolk sac diameter, i.e. normal or abnormal, for prediction of early pregnancy outcome, i.e. good outcome (continuation of pregnancy beyond 20 weeks of gestation) or poor outcome (any type of abortion (except medical or surgical) before 20<sup>th</sup> week of gestation). This study found that the sensitivity of normal yolk sac diameter for predicting good outcome is 91.45% indicating that normal diameter of yolk sac accurately predicts good outcome in 91.45% cases. Specificity indicates that abnormal diameter of yolk sac predicts poor outcome in 87.88% cases. Positive predictive value of yolk sac diameter is 96.4% indicating that a patient with normal diameter of yolk sac has 96.19% chances of good pregnancy outcome. Negative predictive value indicates that patient with abnormal diameter of yolk sac has 64.44% chances of poor pregnancy outcome.

## Discussion

In the first trimester, chromosomal abnormalities of the embryo or foetus, advanced maternal age, uterine anomalies, teratogen and mutagen agents, maternal diseases, placenta anomalies, maternal trauma, endocrine and immune diseases, and maternal diseases are the most common causes of spontaneous miscarriage. The present study was conducted among 150 pregnant women to evaluate the role of yolk sac diameter as a predictor of pregnancy outcome. In present study majority of the cases were in 21-25 years. Out of total 150 women, 66 (44.0%) were belong to 21-25 years followed by 53 (35.3%) were in 26-30 years. In the study by Tawfik WM (2021), among 54 cases majority of the cases in the range of 25-30 years. In present study out of total 150 cases, 69 (46.0%) were primigravida, 81 (54%) were multigravida. According to a study by

Bhattarai A et al. (2020), four adverse pregnancy outcomes happened in primigravida, two in second gravida, two in third gravida, and one in fourth gravida; three of the women had prior abortions, and the fourth had two. In present study out of total 150 pregnant women, 66 (44%) were completed 6 weeks at the time of enrolment followed by 43 (28.7%) were completed 7 weeks. 28 (18.7%) were completed 8 weeks and 1 (8.7%) were completed 9 weeks of gestation. In the study by Tawfik WM (2021), out of total 54 cases most of the cases were completed 6 to 7 weeks of gestation followed by 11 cases completed 8 to 9 weeks of gestation. In present study, at 9 weeks of gestation mean age of the yolk sac diameter is 5.575 mm followed by 5.319 mm at 8 weeks. Similar results observed in study by Bhattarai A et al. (2020) and Tawfik WM (2021). In present study out of total 117 cases, 54 (46.2%) were found good outcome at 6 weeks followed by 35 (29.9%) at 7 weeks of gestation. At 8 weeks 19 (16.2%) and at 9 weeks 9 (7.7%) were found good outcome. Out of total 33 cases, 12 (36.4%) were found poor outcome at 6 weeks followed by 9 (27.3%) at 8 weeks of gestation. At 7 weeks 8 (24.2%) and at 9 weeks 4 (12.1%) were found poor outcome. Hewidy MM et al (2022), out of total 46 pregnant women 7 (15.2%) cases were found fetal loss at 6 weeks of gestation, 39 (84.8%) cases had good outcome. At 9 weeks of gestation 35 (76.1%) had good outcome and 4 (10.25%) were found fetal loss. At 12 weeks of gestation 32 (69.6%) had good outcome and 3 (8.57%) were found fetal loss. In present study out of total 117 cases, 99 (84.6%) were found good outcome at normal yolk sac diameter followed by 10 (8.5%) at smaller yolk sac diameter. Out of total 33 cases, 28 (84.8%) were found poor outcome at greater yolk sac diameter followed by 3 (9.1%) at smaller yolk sac diameter. In the study by Tawfik WM (2021), out of total 52 cases, 42 (80.8%) were found normal yolk sac diameter followed by 4 (7.7%) enlarged, 3 (5.8%) small, 2 (3.8%) irregular and 1 (1.9%) absent. In present study out of total 15 cases in greater yolk sac diameter, 5 were found normal outcome, 1 spontaneous abortion and 9 were found missed abortion. Out of total 44 cases in normal yolk sac diameter, 43 were found normal outcome and 1 case was found missed abortion. Out of total 7 cases in smaller yolk sac diameter, 6 were found normal outcome and 1 was found missed abortion. Hewidy MM et al (2022) noted that at 6 weeks of gestational age, yolk sac diameter was significantly greater in cases of abortion than in cases of continuation of pregnancy (mean diameter of yolk sac in abortion cases was 3.51.8 mm and in abortion cases who continued pregnancy was 2.2±0.4 mm). The mean YSD for cases that were aborted at 9 weeks was 4.1 mm, whereas for cases that continued pregnancy at 9 weeks, it was 4.6 mm. Cases that were aborted at 12 weeks were 5.3 mm, while successful cases at 12 weeks were 5 mm. On the other hand, there was a statistically insignificant difference between YSD in aborted cases and those that continued pregnancy at 9 and 12 weeks, respectively. In present study out of total 10 cases in greater yolk sac diameter, 3 were found normal outcome, 1 spontaneous abortion and 6 were found missed abortion. Out of total 30 cases in normal yolk sac diameter, all the cases were found normal outcome. Out of total 3 cases in smaller yolk sac diameter, 2 were found normal outcome and 1 was found spontaneous abortion. Sensitivity and PPV of YSD when employed as a predictor to assess the first trimester pregnancy outcome were both above 90% in the study by Bhattarai A et al (2020). At seven weeks, GA had a 96% sensitivity and a 50% specificity. 96% of predictions were optimistic, whereas just 50% of predictions were negative. In the study by Bhattarai A et al (2020). At 8 weeks, GA had an 88.2% sensitivity and a 66.6% specificity. 93.7% of predictions were optimistic, whereas just 66.6% of predictions were negative. In present study, two cases in greater yolk sac diameter were found missed abortion. Out of total 10 cases in normal yolk sac diameter, 9 were found normal outcome and 1 was found missed abortion. One cases in smaller yolk sac diameter, was found missed abortion. In the study by Bhattarai A et al (2020). At 9 weeks, GA had a 95.2% sensitivity and a 50% specificity. 95.2% of predictions were optimistic, whereas just 50% of predictions were negative. In present study out of total 36 cases in greater yolk sac diameter, 8 were found normal outcome, 2 spontaneous abortion, 1 threatened abortion and 25 were found missed abortion. Out of total 101 cases in normal yolk sac diameter, 99 cases were found normal outcome, 1 spontaneous abortion and 2 were found missed abortion. Out of total 13 cases in smaller yolk sac diameter, 10 cases were found normal outcome, 1 spontaneous

abortion, 1 threatened abortion and 29 were found missed abortion. In present study out of total 117 cases in good outcome, 101 (86.3%) were found regular and 16 (13.7%) were found irregular yolk sac shape at first visit and final follow up visit. Out of total 33 cases in poor outcome, 4 (12.1%) were found regular and 29 (87.9%) were found irregular yolk sac shape at first visit and final follow up visit. (P value <0.001) In present study out of total 117 cases in good outcome, 107 (91.5%) were found Normal and 10 (8.5%) were found abnormal yolk sac diameter at first visit and final follow up visit. Out of total 33 cases in poor outcome, 4 (12.1%) were found normal and 29 (87.9%) were found abnormal yolk sac diameter at first visit and final follow up visit. (P value <0.001) Small YS size was discovered in 5.7% of instances in the study by Tawfik WM (2021), which was little more (3.7%) than what Jose et al. discovered. These results confirm that a small YSD is linked to a poor first trimester outcome. The abnormal (irregular) YS size was discovered in 5.7% of cases in the study by Tawfik WM (2021), which was slightly higher (3.7%) than the result observed by Jose et al. Present study found that the sensitivity of yolk sac shape for predicting good outcome is 86.32% indicating that regular shape of yolk sac accurately predicts good outcome in 86% cases. Specificity indicates that irregular shape of yolk sac predicts poor outcome in 87.88% cases. Positive predictive value of yolk sac shape is 96.19% indicating that a patient with regular shape of yolk sac has 96.19% chances of good pregnancy outcome. Negative predictive value indicates that patient with irregular shape of yolk sac has 64.44% chances of poor pregnancy outcome. In the study by Tawfik WM (2021), it was discovered that enlarged YS (4 cases), irregular or absent YS (one case each), and foetal loss were all significantly correlated. This indicates that YSD measurement was an accurate predictor of first trimester outcome. Present study found that the sensitivity of normal yolk sac diameter for predicting good outcome is 91.45% indicating that normal diameter of yolk sac accurately predicts good outcome in 91.45% cases. Specificity indicates that abnormal diameter of yolk sac predicts poor outcome in 87.88% cases. Positive predictive value of yolk sac diameter is 96.4% indicating that a patient with normal diameter of yolk sac has 96.19% chances of good pregnancy outcome. Negative predictive value indicates that patient with abnormal diameter of yolk sac has 64.44% chances of poor pregnancy outcome. Similar result observed in the study by Tawfik WM (2021), Yolk Sac Diameter had a total accuracy of 98.1% and had a 97.6% sensitivity and specificity of 100% in predicting miscarriage.

### **Conclusion**

Greater yolk sac diameter had a poorer outcome compared to cases with normal yolk sac diameter, missed abortion being the most common adverse finding. Yolk sac shape and size assessment gives a good overview of pregnancy outcome in first trimester. Hence, it is advised that yolk sac biometry be done routinely in first trimester.

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