



## PREDICTION OF EARLY PREGNANCY FAILURE BY TRANSVAGINAL ULTRASONOGRAPHY IN FIRST TRIMESTER – AN OBSERVATIONAL STUDY IN A TERTIARY HEALTH CARE FACILITY IN WEST BENGAL

<b>Anwshka Kumari</b>	Junior Resident, Department of Obstetrics & Gynecology Burdwan Medical College, Burdwan.
<b>Rajib Pal*</b>	Associate Professor, Department of Obstetrics & Gynecology, Deben Mahata Government Medical College, Purulia. *Corresponding Author
<b>Suman Das</b>	Senior Resident, Department of Community Medicine, Malda Medical College, Malda.
<b>Mrinal Kanti Ghosh</b>	Professor, Department of Radiodiagnosis and Imaging, Professor Department of Obstetrics & Gynecology, Burdwan Medical College, Burdwan West Bengal.
<b>Prabir Sengupta</b>	Professor Department of Obstetrics & Gynecology, Burdwan Medical College, Burdwan West Bengal.

### ABSTRACT

**Background:** Spontaneous miscarriage is defined as an involuntary termination of pregnancy before 20th week of gestation or spontaneous expulsion of fetus below a fetal weight of 500 gm. Antenatal ultrasonography has been extremely useful in providing better understanding the etiology of first trimester spontaneous abortion and a basis for its clinical classification and management. The aims and objective of this study is to assess the early pregnancy developmental changes in first trimester ultrasound screening, identify abnormal ultrasound parameters and correlate the ultrasonic findings with the clinical outcomes.

**Methods:** The study included 100 pregnant women attending outpatient department or admitted in the hospital at 5-12 weeks of gestation fulfilling inclusion and exclusion criteria.

**Results:** The abortion rate in our study was 34%. Out of that 18% abortion occurred at < 8 weeks and 16% occurred at 8-12 weeks of gestation. In this study, 30 patients had threatened abortion out of which 23(76 %) had abnormal TVS parameters. In our study 44 patients had abnormal findings in TVS, of which 32 (72.7%) had EPF.

**Conclusions:** This study emphasizes the role of ultrasound in prediction of early pregnancy failure in first trimester. It can also help in taking decision whether to continue, abort or follow conservative management in early pregnancy.

**KEYWORDS :** Early pregnancy failure, Spontaneous abortion, ultrasonography in first trimester.

### INTRODUCTION

Antenatal ultrasonography (USG) has revolutionized the management of early pregnancy failure<sup>1</sup>. Spontaneous miscarriage is involuntary termination of pregnancy before 20<sup>th</sup> week of gestation or spontaneous expulsion of fetus below fetal weight of 500 grams<sup>2</sup>. Approximately 12-24% of all pregnancies suffer miscarriages and 80% of all cases of pregnancy loss occur within the first trimester and most of the early miscarriages are caused by chromosomal abnormalities, and the risk of which increases with maternal age<sup>3</sup>. Common symptoms of early pregnancy loss like vaginal bleeding and abdominal cramping are also common in normal gestation, ectopic pregnancy, and molar pregnancy<sup>4</sup>.

The advent of high-resolution transvaginal ultrasound (TVS) has revolutionized understanding pathophysiology and management of early pregnancy failure (EPF)<sup>5</sup>. TVS allows the probe to be placed closer to the uterus and therefore higher frequency probes can be used<sup>6</sup>. This result in improved spatial resolution and near field focussing compared with transabdominal ultrasonography (TAS)<sup>6</sup>. Consequently, the findings of an intrauterine pregnancy can be seen at an earlier gestational age<sup>6</sup>.

Ultrasonography in first trimester should include a thorough evaluation of the uterus and adnexa which should localise gestational sac, embryo, yolk sac and cardiac activity if embryo is present<sup>7</sup>. TVS findings can be conclusive of EPF or can be suggestive. If the findings are suggestive of EPF, then the patient should be followed up after 11-14 days. This study is aimed to assess the accuracy of first trimester USG markers i.e. mean gestational sac diameter (MGSD), Yolk sac (YS),

crown rump length (CRL), embryonic heart rate (EHR), retroplacental or perisac collection to predict the risk of EPF. This study also aims to identify abnormal ultrasound parameters and correlate the ultrasound findings with the clinical outcomes.

### MATERIALS AND METHODS

This was an observational study conducted in the Department of Obstetrics and Gynecology, Burdwan Medical College and Hospital, Burdwan, West Bengal for a period of one year from June 2018 to May 2019. The study was approved by ethical committee and an informed consent was taken from the participants. 100 pregnant women were selected attending the hospital at 5-12 weeks of gestation fulfilling inclusion and exclusion criteria. The study included all age, any parity, single intrauterine pregnancy, pregnant women with estimated gestational age of 5-12 weeks with accurate last menstrual period (LMP) with previous history of regular cycle and any subject of threatened abortion.

Patient refusal, multiple pregnancies, known fetal or uterine abnormalities, chronic diseases were excluded from the study. Selected patients were subjected to transvaginal ultrasound examination using USG Machine (Philips HD7) with transvaginal probe of frequency 5-7.5 MHz. All the cases were subjected to detailed history, general, physical, systemic and obstetrical examination. Patient was asked to void her urine before the procedure. The disinfected endovaginal probe was covered with a sterile condom lubricated with gel before insertion. The transducer was inserted approximately 6-8 cm into the vagina in lithotomy position. Gestational age was calculated by CRL or MGSD if embryo was absent. LMP and ultrasound derived gestational age was compared and

marked discrepancy of  $\leq 1$  week led to exclusion. MGSD was assessed by averaging three dimensions (longitudinal, anteroposterior and transverse). Sac was measured from inside of the sac to the inside of the decidual reaction. Yolk Sac diameter was determined by placing calipers on the inner limits of the longer diameter. YS having diameter between 3-6 mm, rounded shape, absence of degenerative changes, presence of echogenic rim and hypoechoic centre was considered normal. Any deviation from above parameters was considered abnormal. CRL was measured in sagittal plane of the embryo avoiding inclusion of YS. CRL  $> 4$  mm in TVS who fail to demonstrate heart beat were judged as non-viable and CRL  $< 4$  mm without a visible heart beat were asked to return for repeat USG after 7 days. EHR  $< 100$ /minute at 8 weeks or earlier was classified as slow. Presences of any perisac collection or hemorrhage were noted. Participants were followed up to 20 weeks to see the final outcome. All USG were done and reviewed by a single radiologist to reduce the observational bias. Outcome of pregnancy was defined as adverse if there was spontaneous abortion. EPF is said when abortion occurred at  $\leq 12$  weeks and late when abortion occurred  $> 12$  weeks.

**RESULTS AND ANALYSIS**

Distribution of women by age, parity and outcome is depicted in Table 1. Table 2 and 3 shows the distribution of each parameter and their predictive value. Table 4 and 5 shows same parameters and their predictive value in women with threatened abortion. Chi-square test was applied to find out any association between pregnancy outcome and early pregnancy parameters

**Table 1: Distribution of study subjects according to certain characteristics**

	Frequency	Percent
<b>Age in years among all pregnant women (n=100)</b>		
$\leq 20$	15	15.0
21-25	23	23.0
26-30	39	39.0
$> 30$	23	23.0
<b>Parity among all pregnant women (n=100)</b>		
P <sub>0+0</sub>	49	49.0
P <sub>0+1</sub> to P <sub>0+5</sub>	22	22.0
P <sub>1+0</sub> to P <sub>2+0</sub>	21	21.0
P <sub>3+0</sub>	8	8.0
<b>Age among pregnant women with outcome as abortion (n=34)</b>		
$\leq 20$	4	11.7
21-25	8	23.5
26-30	11	32.4
$> 30$	11	32.4
<b>Parity among pregnant women with outcome as abortion (n=34)</b>		
P <sub>0+0</sub>	14	41.2
P <sub>0+1</sub> to P <sub>0+5</sub>	11	32.4
P <sub>1+0</sub> to P <sub>2+0</sub>	8	23.5
P <sub>3+0</sub>	1	2.9
<b>Period of gestation in weeks among pregnant women with outcome as abortion (n=34)</b>		
$< 8$	18	52.9
8 to 12	16	47.1

**Table 2: Distribution of abnormal parameters in TVS among all pregnant women (n=100)**

Abnormal parameters	Frequency	Percent
MSD $> 25$ with No Embryo	14	14.0
YSD $> 6$ mm	4	4.0
Abnormal Morphology of YS	3	3.0
CRL $> 4$ mm with No Cardiac Activity	8	8.0
SCH or PGH	4	4.0
EHR $< 100$ bpm	3	3.0

**Table 3: Inter-relationship of different TVS parameters and prediction value (n=34)**

TVS Parameters	TP	TN	FP	FN	PPV	NPV	Diagnostic accuracy
MSD $> 25$ mm and Embryo Absent	14	50	0	13	100.00	79.37	83.12
CRL $> 4$ mm and Cardiac Activity Absent	6	60	2	13	75.00	82.19	81.48
YSD $> 6$ mm	4	66	0	30	100.00	68.75	70.00
EHR $\leq 100$ min	2	57	1	11	66.67	83.82	83.10
SCH or PGH presence	2	64	2	32	50.00	66.67	66.00
Abnormal USG : Threatened Abortion	19	7	4	0	82.61	100.00	86.67
Predictive	13	12	0	19	100.00	38.71	56.82
Abnormal USG	32	54	12	2	72.73	96.43	86.00

**Table 4: Association between TVS report and pregnancy outcome in threatened abortion (n=30)\***

USG report	Live [No(%)]	Dead [No(%)]	p value <sup>#</sup>
Abnormal	4 (17.4)	19 (82.6)	<b><math>&lt; 0.001</math></b>
Normal	7 (100.0)	0 (0.0)	

Note:\* Fisher's Exact Test # p value  $< 0.05$  has been considered significant

**Table 5: Inter-relationship between different abnormal parameters in threatened abortion and prediction value**

TVS Parameters	TP	TN	FP	FN	PPV	NPV	Diagnostic accuracy
MSD $> 25$ mm and Embryo Absent	8	4	0	11	100.00	26.67	52.17
CRL $> 4$ mm and Cardiac Activity Absent	4	3	1	15	80.00	16.67	30.43
Abnormal Yolk Sac	5	4	0	14	100.00	22.22	39.13
SCH or PGH presence	2	2	2	17	50.00	10.53	17.39
Other Anomaly	0	3	1	19	0.00	13.64	13.04

**DISCUSSION**

In pregnancies aged 5-20 weeks, the incidence of miscarriage is 11-20% and is higher in earlier weeks<sup>8</sup>. In our study 34% of pregnancies suffered spontaneous abortion, out of which 11% were more than 30 years of age. Increasing maternal age was found to be a risk factor for miscarriage<sup>9</sup>. Embryo should be present where MSD is  $> 25$  mm. Approximately 94% of EPF occur in MSD  $> 25$  mm without an embryo<sup>10</sup>. In our study 14% miscarriages had MSD  $> 25$  mm without an embryo showing positive correlation. Abnormal size and calcification of YS leads to spontaneous miscarriage<sup>11</sup>. Larger yolk sac is associated with poor pregnancy outcome. Our study showed 4% of EPF occurred with yolk sac  $> 6$  mm. The cut-off CRL for detecting cardiac activity by TVS is 4 mm and by TAS is 9 mm<sup>10, 12</sup>. Different studies documented that a slow EHR at 7-9 weeks gestation is associated with high rate of EPF<sup>13</sup>. In our study we found out 3 who had EHR  $< 100$ , 2 were aborted. Any collection or hemorrhage around gestational sac has been associated with poor pregnancy outcome and same findings were seen in our study<sup>14</sup>. SCH or PGH were found in 4 women in our study out of which 2 miscarried giving a positive predictive value of 50%<sup>14</sup>.

In our study, 30 patients had threatened abortion out of which 23(76 %) had abnormal TVS parameters of which 19 (82.6%) patients suffer miscarriage. In cases of threatened abortion in our study as shown in table 5, 8 out of 30 had MGSD  $> 25$ mm with no embryo and all suffered EPF<sup>15</sup>. 4 out of 5 pregnancies with CRL  $> 4$ mm without cardiac activity miscarried<sup>16</sup>. All 5 pregnancies with abnormal yolk sac in TVS had abortion<sup>16</sup>. Out of total 4 patients with SGH 2 had EPF and 2 progress normally further<sup>17</sup>. In our study 44 patients had abnormal

findings in TVS, of which 32 (72.7%) had EPF. Out of 31 abnormal findings, 12 pregnancies were found to be normal in subsequent TVS after 1 week and absolutely normal till 20 weeks.

## CONCLUSION

Ultrasound plays a vital role in diagnosis and management of early pregnancy and especially TVS is better as abnormal parameters can be diagnosed earlier than TAS. TVS can help in early diagnosis of EPF in asymptomatic patients. It can avoid continuation of abnormal pregnancy and reduce the number of unnecessary terminations of pregnancy with symptoms of EPF.

## REFERENCES

1. Jauniaux E, Johns J, Burton GJ. The role of ultrasound imaging in diagnosing and investigating early pregnancy failure. *Ultrasound Obstet Gynecol.* 2005;25; 613-24.
2. Speroff L, Fritz MA. Recurrent early losses. *Clinical gynecological endocrinology and infertility.* 7th edition. Philadelphia: Lippincott Williams and Wilkins; 2005:1069.
3. Jurkovic D, Overton C, Bender AR. Diagnosis and management of first trimester miscarriage. *British Med J.* 2013;346:3676.
4. American College of Obstetrician and Gynecologists. Early Pregnancy loss. *ACOG Practice Bulletin No. 200.* *ObstetGynecol* 2018; Vol 132 No. 5; e197-207.
5. Jauniaux E, Johns J, Burton GJ. The role of ultrasound imaging in diagnosing and investigating early pregnancy failure. *Ultrasound ObstetGynecol* 2005; 25(6); 613-24.
6. Graham III GM; *Ultrasound Evaluation of Pregnancy in the First Trimester;* Donald School Journal of *Ultrasound in Obstetrics and Gynecology;* 2010; 4(1); 17-28.
7. American College of Obstetricians and Gynecologists. *Ultrasonography in pregnancy.* *ACOG Practice Bulletin No. 58.* *ObstetGynecol* 2004;104;1449-58.
8. Ammon Avalos L, Galindo C, Li DK. A systematic review to calculate background miscarriage rates using life table analysis. *Birth Defects Res A Clin Mol Teratol.* 2012 Jun;94(6):417-23.
9. Buss L, Tolstrup J, Munk C, Bergholt T, Ottesen B, Gronbaek M, Kjaer SK. Spontaneous abortion: a prospective cohort study of younger women from the general population in Denmark. Validation, occurrence and risk determinants. *Acta ObstetGynecol Scand.* 2006;85(4):467-75
10. Pennell RG, Needelman L, Pajak T. Prospective comparison of vaginal and abdominal sonography in normal early pregnancy. *J Ultrasound Med.* 1991;10:63-7.
11. Kucuk T, Duru NK, Yenen MC, Dede M, Ergun A, Baser I. Yolk sac size and shape as predictors of poor pregnancy outcome. *J Perinat Med.* 1999;27:316-20.
12. Levi CS, Lyons EA, Zheng XH. Transvaginal US: Demonstration of cardiac activity in embryos less than 5.0 mm in crown-rump length. *Radiology.* 1990; 176:71-4.
13. Chittacharoen A, Herabutya Y. Slow fetal heart rate may predict pregnancy outcome I first trimester threatened abortion. *FertilSteril.* 2004;82:227-9.
14. Bennett GL, Bromley B, Lieberman E, Benacerraf BR. Subchorionic hemorrhage in first-trimester pregnancies: prediction of pregnancy outcome with sonography. *Radiology* 1996;200:803±6.
15. Benson CB, Doubilet PM. Slow embryonic heart rate in early first trimester: indicator of poor pregnancy outcome. *Radiology.* 1994 Aug;192(2):343-4. doi: 10.1148/radiology.192.2.8029394. PMID: 8029394.
16. Lebda I, El-Fawal F, El-samak A and Abo Elwan H\*. Prognostic Factors of Ultrasonography of Yolk Sac Size and Embryonic Heart Rate in First Trimester Pregnancy Outcome. *ZUMJ* 2019;25(6):801-808.Doi:10.21608/ zumj. 2019. 11089.11440.
17. Ben-Haroush A, Yogev Y, Mashiach R, Meizner I. Pregnancy outcome of threatened abortion with subchorionic hematoma: possible benefit of bed-rest? *Isr Med Assoc J.* 2003 Jun;5(6):422-4. PMID: 12841015.