

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20223123>

Original Research Article

Utility of first trimester ultrasound before 12 weeks of gestation at tertiary care centre in western India

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Received: 27 September 2022

Revised: 31 October 2022

Accepted: 01 November 2022

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ABSTRACT

Background: The first trimester begins on the first day of the last menstrual period (LMP) and lasts until the end of 12 weeks of gestation. Transvaginal ultrasound is modality of choice for establishing the presence of an intrauterine pregnancy in the first trimester. The focus of our study is routine early pregnancy ultrasound. The purpose of this study was to diagnose various conditions of pregnancy at an early stage by using ultrasound.

Methods: We conducted retrospective data analysis of random 250 pregnant patients who had undergone first-trimester ultrasonography (USG) (transvaginal/abdominal) in their first antenatal visit at S.V.P. Hospital, Ahmedabad, Gujarat, India from March 2021 to February 2022. The patient was selected by a simple randomized method. Maternal age, parity, gestational age, and special features regarding maternal gestational history were compared with USG findings. Patients were divided into 13 groups on the basis of ultrasonographic diagnosis.

Results: We noted 76.8% of patients had single, viable, intrauterine pregnancies, while 23.2% had complicated pregnancies with uterine anomalies, ovarian cysts, leiomyoma, caesarean scar pregnancy or subchorionic hematomas.

Conclusions: Ultrasound measurement of fetus in first trimester is most accurate method to confirm gestational age. It is less expensive and easily available modality. First-trimester ultrasound is useful to define embryonic landmarks in developmental stages with reference to gestational age, early diagnosis of miscarriage, ectopic pregnancy, molar pregnancy, multifetal pregnancy, major fetal malformation. And also, to diagnose pregnancy with leiomyoma, caesarean scar pregnancy, uterine anomaly and pre-eclampsia with the help of uterine artery PI.

Keywords: First trimester, Miscarriage, Leiomyoma

INTRODUCTION

The first-trimester pregnancy is the most fascinating period of human development.¹ The first trimester of pregnancy is – “the dynamic period that spans ovulation, fertilization, implantation, and organogenesis”. It is the most critical and tenuous period in human existence. However, it is fraught with a high complication rate.^{2,3}

The first trimester begins on the first day of the last menstrual period and lasts until the end of 12th week. The

purpose of first-trimester ultrasonography is to visualize viability, establish pregnancy dating, detect multiple pregnancies, observe uterine adnexal structures, measure nuchal translucency, evaluate foetal gross anomaly and detect other early pregnancy complications.

To accurately assess first-trimester pregnancy, the gestational sac (GS) size or embryonic crown-rump length (CRL) should be compared with the menstrual age. An intrauterine GS is the first landmark that is consistently observed on ultrasound in early pregnancy. The GS can be

visualized as early as 4.5 weeks by the transvaginal technique.^{4,5}

Anembryonic pregnancy or blighted ovum is a form of failed pregnancy and is defined as a GS in which the embryo fails to develop. The first structure to become visible within the GS is the yolk sac. The second structure that becomes sonographically visible within the GS is the embryo, which should be observed transvaginally when the GS measures 18 mm, and transabdominal when the GS measures ≥ 25 mm.^{6,7}

In multifetal gestation, ultrasound examination includes the examination of a number of fetuses, confirmation of cardiac activity, crown rump length and/or biparietal diameters, chorionicity or amnionicity, and nuchal translucency assessment.

Subchorionic hematoma is defined as bleeding resulting in marginal abruption with separation of the chorion from the endometrial lining.⁸ Subchorionic hematoma (SCH) is a relatively common finding in the first trimester and has been reported to occur in 18-22% of intra-uterine pregnancies in patients presenting with vaginal bleeding.^{9,10}

Ultrasonography (USG) is a sensitive and reliable method for diagnosing molar pregnancy. When there is a suspicion of a hydatidiform mole based on symptoms or signs, ultrasound permits an accurate diagnosis of this neoplasm. Early diagnosis of a hydatidiform mole is desirable to decrease the risk of significant complications, particularly those related to respiratory function.¹¹

Major fetal malformation can diagnose in early gestation are anencephaly-exencephaly sequence, alobar, and semi lobar holoprosencephaly, large encephalocele, pentalogy of cantrell (severe thoraco-abdominal wall defect with ectopia cordis and exomphalos), gastroschisis, large omphalocele (watch-out for possible physiologic herniation of the bowel), limb-body-wall complex, cystic hygroma, gross limb defects and Frank hydrops. Further, uterine duplication anomalies and septate uterus are associated with a high pregnancy loss rate.¹²

METHODS

The retrospective data analysis of randomly selected 250 pregnant patients who had undergone first-trimester ultrasonography scanning in their first antenatal visit in S.V.P. Hospital Ahmedabad, from March 2021 to February 2022. The selection of patients for USG was from both outpatient and patients in wards. Data were statistically analyzed using statistical package for the social sciences (SPSS) software.

Inclusion criteria

Normal, as well as symptomatic patients with complaints of bleeding per vaginum, abdominal pain, excess

vomiting, brownish discharge, giddiness, and positive serum β -hCG level (above 1500 IU/ml), were selected.

Exclusion criteria

Pregnant patients with chronic metabolic diseases and known genital tract pathology or lesions were excluded.

Written and informed consent was taken from all selected patients. Patients were scanned by TVS probe with an empty bladder and/or transabdominal probe with full bladder after explaining the procedure and filling out the F form.

Ultrasonographic examinations were performed by an obstetrics and gynecology specialist with a transabdominal convex probe (3.5 Hz) and transvaginal probe (5 Hz).

Age, parity, gestational age, special features regarding maternal gestational history—such as Rh-Rh isoimmunization, ultrasonographic findings, CRL or GS diameter, and fetal cardiac activity, as well as the presence/absence of subchorionic hematoma (SCH), multiple pregnancies, anembryonic pregnancy, adnexal mass, ectopic pregnancy, caesarean scar pregnancy, molar pregnancy, leiomyoma, and/or uterine anomalies, were noted in the ultrasonographic examination.

The patients were divided into 13 different groups according to their ultrasonographic diagnosis. The groups were normal, blighted ovum, multifetal pregnancy, ectopic pregnancies, subchorionic hematoma, threatened abortion, missed abortion, incomplete abortion, major fetal malformation, caesarean scar pregnancy, uterine anomaly, and leiomyomas and ovarian cysts with a viable pregnancy.

All anembryonic pregnancies were diagnosed by the transvaginal technique using a 5-Hz probe. A mean GS diameter >20 mm (transvaginal ultrasound) without a visualized embryo was considered as an anembryonic pregnancy.

RESULTS

In our study 25% of patients were below 20 years of age, 67% of patients were from 21-35 years of age and 8% of patients were more than 35 years of age. Table 2 shows the overall percentage of different ultrasonographic diagnostic findings and their distribution according to age groups (<20 years, 20-35 years, and >35 years).

Table 1: Distribution of age.

Age (years)	Percentage of patients
<20	25
20-35	67
>35	08

We analyzed 250 first trimester pregnancy ultrasonography findings. Out of these, 75.6% (189) patients had a single, viable, normal intrauterine pregnancy. The total Blighted ovum reported in the study was 8 (3.2%). 35 miscarriages (14%) were reported during the study. The most common type of miscarriage was threatened abortion (8%) followed by missed abortion (4%) and incomplete abortion (2%). The multifetal pregnancy was reported 0.8% and ectopic pregnancy was

0.4%. In our study, 15 women had complicated pregnancies. The most common complication was subchorionic hematomas (n=8) followed by a uterine anomaly (n=2), ovarian cysts (n=2), major congenital anomaly(n=1), caesarean scar pregnancy (n=1) and leiomyoma (n=1). And has been compared with a retrospective study conducted at the University of Uyo teaching hospital (UUTH), Uyo, Nigeria.¹³

Table 2: Ultrasonographic diagnosis.

Groups	Total (no. of patients in our study), N	Percentage (in our study)	Percentage (retrospective study: UUTH, Uyo, Nigeria)
Normal	189	75.6	42.5
Blighted ovum	8	3.2	6.5
Threatened abortion	20	8	3.3
Missed abortion	10	4	2.8
Incomplete abortion	5	2	34.3
Subchorionic hematoma	8	3.2	
Multifetal pregnancy	2	0.8	2.19
Ectopic pregnancy	1	0.4	5.9
Uterine anomaly	2	0.8	
Ovarian cyst	2	0.8	7.30
Major congenital anomaly	1	0.4	
Leiomyoma	1	0.4	13.87
Caesarean scar pregnancy	1	0.4	

The total number of patients showing abnormal mean uterine artery PI was six (2.4%) (Table 3).

Table 3: Comparison of a study showing abnormal uterine artery mean PI.

Parameters	In our study
No. of patient examined	250
No. of a patient with abnormal uterine artery PI	6
Percentage (%)	2.4

DISCUSSION

First-trimester ultrasound is often done to assess pregnancy location and thus it overlaps between an obstetric and gynecologic ultrasound examination. Accurate performance of an ultrasound examination in the first trimester is important given its ability to confirm an intrauterine gestation, assess viability and number of the embryo(s), and accurately date a pregnancy, all of which are critical for the course of pregnancy. Our study focused on the diagnostic value of first trimester ultrasound before 12 weeks of gestation. Majority of the subjects in the present study were in the age of 21-30 years which was comparable with the previous studies.¹⁴⁻¹⁶

One of the most important aspects of obstetric ultrasound in the 1st trimester is the dating of pregnancy; this is accomplished by performing a few simple biometric measurements: the GS diameter, when no embryo is seen;

the length of the embryo or Crown-Rump length (CRL); and in the late 1st trimester (12-13 weeks), the biparietal diameter (BPD). The obtained values are to be compared with established reference ranges to provide an accurate dating. Measuring the embryo or the fetus or other structures before 14 weeks is the most reliable way to estimate gestational age by ultrasound. Once an established date of delivery is assigned to pregnancy following an ultrasound examination, irrespective of whether the assigned established dates were those by ultrasound or by menstrual dates, these dates should not be changed during pregnancy. If a patient reports no menstrual dates, an ultrasound in the first or second trimester should establish the estimated date of delivery.

A large GS (mean sac diameter >25 mm) with an absent embryo is diagnostic of a failed pregnancy. When the mean sac diameter is between 16 and 24 mm, the absence of an embryo is suspicious, though not diagnostic, for a failed pregnancy.

The germinal stage (3-5 weeks of gestation) is the period of gestation from fertilization/conception to implantation of the embryo. The embryonic stage (8-10 weeks of gestation) is the period of organogenesis, and most congenital malformations are known to arise in this period. Our study is focused on the diagnosis value of first-trimester ultrasound before 12 weeks of gestation. The majority of the subjects in the present study were between the age of 21-35 years which was comparable with the previous studies.

Table 4: Ultrasonographic signs of early pregnancy failure in the first trimester.

S. no.	Ultrasonographic signs of early pregnancy failure in the first trimester
1	Crown-Rump length of equal to or greater than 7 mm without cardiac activity
2	Mean sac diameter of equal to or greater than 25 mm without an embryo
3	Absent embryo with heartbeat at >2 weeks after an ultrasound that showed a G sac without a yolk sac
4	Absent embryo with heartbeat at 11 days or more after an ultrasound that showed a G sac with a yolk sac

In our study, 75.6% (189) patients had a single, viable, normal intrauterine pregnancy. The total blighted ovum reported in the study was 8 (3.2%). 35 miscarriages (14%) were reported during the study. The most common type of miscarriage was threatened abortion (8%) followed by missed abortion (4%) and incomplete abortion (2%). The multifetal pregnancy was reported 0.8% and ectopic pregnancy was 0.4%. And 15 women had complicated pregnancies. All the diagnosis in our study were nearly comparable to the study conducted by Celen et al.¹⁷

The most common complication was subchorionic hematomas (n=8) followed by a uterine anomaly (n=2), ovarian cysts (n=2), major congenital anomaly (n=1), caesarean scar pregnancy(n=1) and leiomyoma(n=1).

In our study, out of 250 patients, 6 (2.4%) patients showed increased uterine artery mean PI which is an early predictor of preeclampsia, preterm deliveries, IUGR, and small for gestational age babies. By recognizing early Doppler changes we can prevent later complications by appropriate medication like low dose aspirin and low molecular weight heparin in the first trimester in the patients showing significant Doppler changes.

The measurement of the CRL in the first trimester is the most important parameter to establish gestational age. In our study, 75.6% (189) patients had single, viable, intrauterine normal pregnancies.

Twins and higher-order multiple gestations are easily diagnosed in early gestation. The first trimester is the most optimum time for the diagnosis of multifetal gestations and for the assessment of chorionicity and amniocity. As pregnancy advances, it becomes more difficult to be certain of the chorionicity of multiple gestations. Twins can share one placenta and are thus referred to as monochorionic (MC). Twins can have two separate placentas and are then called dichorionic (DC). Dichorionic twins are two independent pregnancies within one uterus and with very rare exceptions have no shared placental vascular network between the twins. All dichorionic placentas, by definition, have 2 amniotic sacs and thus are diamniotic also. Dizygotic twins always have dichorionic placentation.

In a dichorionic pregnancy, the dividing membrane shows thickening (“twin peak” or “lambda” sign) as it reaches the placental surface. The incidence of multifetal gestation in our study was 0.8% (2 of 250 pregnancies). Upreti in a hospital record-based study reported the frequency of twin

pregnancy to be 1.9% which was higher compared to the present study.¹⁸

35 miscarriages (14%) were reported during the study. Out of which 20 (8%) was threatened abortion, 10 (4%) had missed abortion, and 5 (2%) had incomplete abortion. Earlier detection of miscarriage would be easier for management as well as the outcome would be better. In cases of threatened abortion earlier diagnosis will be beneficial for conservative management, follow up ultrasound can be done and the outcome may improve.

USG can definitively diagnose an ectopic pregnancy when a gestational sac with a yolk sac, or embryo, or both, is noted in the adnexa. However, most ectopic pregnancies do not progress to this stage. The ultrasound findings of a mass or a mass with a hypochoic area that is separate from the ovary should raise suspicion for the presence of ectopic pregnancy; however, its positive predictive value is only 80%. Early diagnosis is aided by a high index of suspicion. Most cases of tubal ectopic pregnancy that are detected early can be treated successfully either with minimally invasive surgery or with medical management using methotrexate. However, tubal ectopic pregnancy in an unstable patient is a medical emergency that requires prompt surgical intervention. The incidence of ectopic pregnancy in our study was 0.4% (1 of 250 pregnancies). Kharat et al reported 0.76% incidence of ectopic pregnancy which was comparable to our results.¹⁹

Intrauterine hematoma (IUH) is a common condition seen in routine obstetric ultrasound during the first trimester. In our study, the SCH incidence was 4%, women with subchorionic hematoma were at increased risk of abruption, preterm delivery, and preterm premature rupture of membranes. A meta-analysis of seven cohort or case-control studies concluded that women with subchorionic hematoma were at increased risk of abruption, preterm delivery, and preterm premature rupture of membranes.²⁰ Hence, we recommend that diagnosing SCH in first-trimester ultrasonography is necessary for pregnancy follow-up.

Uterine anomalies have been linked with an increased incidence of adverse pregnancy outcomes such as Miscarriage, malpresentation, preterm labour, fetal growth restriction, abnormal placentation, and ectopic pregnancies. In our study uterine anomalies were seen in 0.8% of pregnant patients. Early first-trimester ultrasound helps to detect uterine anomalies and plan proper care and surveillance in order to avoid adverse pregnancy

outcomes. The reported prevalence of uterine anomalies in a meta-analysis conducted by Chan et al was 5.5% in the unselected population, 8.0% in infertile women, 13.3% in those with a history of miscarriage and 24.5% in those with miscarriage and infertility.²¹

According to CSP-new USG grading system for diagnosis of cesarean scar pregnancy, in grade I, the GS was embedded in less than one-half thickness of the myometrium; in grade II, CSP occupied more than one-half depth of the implanted myometrium; in grade III, the GS bulged out of the overlying myometrium and serosa; and grade IV indicated that the GS became an amorphous tumor with rich vascularity at the site of previous cesarean scar.

Use of MTX was choice of treatment in stable patients who wish to preserve their reproductive ability.

Criteria included: gestational sac <7 weeks, β-HCG level <5,000 IU/l, mass diameter <25 mm, and no cardiac action of embryo.

The presence of the myometrium between the GS and bladder wall (Deb et al).

Table 5: Major fetal malformation that can be diagnosed in early gestation.

S. no.	Major fetal malformation that can be diagnosed in early gestation
1	Anencephaly-exencephaly sequence
2	Alobar and semilobar holoprosencephaly
3	Large encephalocele
4	Pentalogy of Cantrell (severe thoraco-abdominal wall defect with ectopia cordis and exomphalos)
5	Gastroschisis
6	Large omphalocele (watch out for possible physiologic herniation of the bowel)
7	Limb-body-wall complex (also known as a body-stalk anomaly)
8	Cystic hygroma
9	Gross limb defects
10	Ovarian cysts were noted in 0.8% of our pregnant patients

Most of the fibroids in pregnancy are asymptomatic, however, they are related to a lot of antepartum, intrapartum, and postpartum complications. These complications include spontaneous miscarriage, antepartum and postpartum hemorrhage, placental abruption, fetal malpresentation, fetopelvic disproportion, premature rupture of membranes, placental retention, preterm labour, low birth weight infants, dysfunctional labour, and an increased need for cesarean deliveries. In our study, the incidence of uterine fibroids with pregnancy was 0.4%.

In our study, the incidence of major congenital malformation was 0.4%. That was generalized subcutaneous swelling s/o cystic hygroma. The advantage of detection of fetal malformation at early gestation is that management and outcome would be better, and psychotrauma would lesser.

Limitations

Limitation of study is by first trimester ultrasound we cannot diagnose all major congenital anomalies, for that second trimester targeted ultrasound for fetal anomalies. Expertise requires for accurate ultrasound imaging. If it finds unclear results or abnormalities on ultrasound that can make people anxious and worried and may also mean that more examination is needed. These additional examinations can be intensive and may difficult for the parents to be cope with.

CONCLUSION

The ultrasound examination in the first trimester is an important step in the evaluation of the pregnancy as it allows for confirmation of intrauterine gestation and for accurate pregnancy dating, but it requires more expertise. First-trimester ultrasound measurement of the embryo or fetus is the most accurate method to confirm gestational age. It is of note that significant change occurs in the first trimester of the normal pregnancy and this change can be detected by transvaginal ultrasound examination. This is the basic knowledge that is needed in order to differentiate a normal from an abnormal gestation. It is a cheap, easily available, and non-invasive imaging modality.

Ultrasound dating of pregnancy is most accurate in the first trimester. First-trimester ultrasound is useful to define embryonic landmarks in developmental stages with reference to gestational age, early diagnosis of miscarriage, early detection of ectopic pregnancy, early diagnosis of molar pregnancy, diagnose multifetal pregnancy for assessing chorionicity, to detect major fetal malformation that can be diagnosed in early gestation, early diagnosis of cesarean scar pregnancy, to detect pregnancy with leiomyoma, to diagnose suspected uterine anomaly and detection of pre-eclampsia, FGR fetus with the help of uterine artery PI. Twins and higher-order multiple gestations are easily diagnosed in early gestation. Earlier detection of miscarriage would be easier for management as well as the outcome would be better. Intrauterine hematoma (IUH) is a common condition seen in routine obstetric ultrasound during the first trimester. Ultrasonography can definitively diagnose an ectopic pregnancy when a gestational sac with a yolk sac, or embryo, or both, is noted in the adnexa. Early first-trimester ultrasound helps to detect uterine anomalies and plan proper care and surveillance in order to avoid adverse pregnancy outcomes. First-trimester ultrasound scan has an excellent value in diagnosis and/or prediction of certain conditions like aneuploidies, certain anomalies, ectopic

pregnancy, and altered uterine artery doppler values in patients at high risk.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Mehta ST, Yadava PA, Jani SK, Solanki TV, Patel AH, Mehta SD, et al. Utility of first trimester ultrasound before 12 weeks of gestation at tertiary care centre in western India. *Int J Reprod Contracept Obstet Gynecol* 2022;11:3318-23.