FOGSI

The Vital Skill
Ultrasound in Obstetrics & Gynecology

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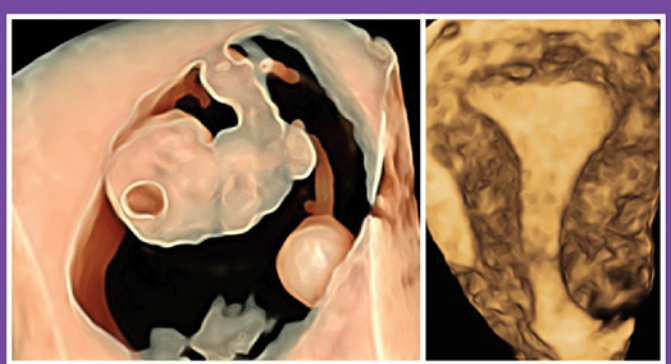

Foreword
Hrishikesh D Pai

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Inverted Pyramid of Antenatal Care

Bela Bhatt

INTRODUCTION

Traditionally about a decade ago, it was a norm to manage complications such as preeclampsia (PE) and fetal growth restriction after they develop in second half of pregnancy. Also, many of the structural anomalies were detected in second trimester or later.

The concept of inverting this pyramid was proposed by Prof Nicolaides who suggested that the combination of first-trimester ultrasound and maternal serum biochemistries at 11–13 weeks casts a much wider diagnostic net to pick up not only aneuploidies but also many structural anomalies and prediction of PE, fetal growth restriction; therefore, the two technologies are best used in combination.[2] Not only that by predicting some of the complications of pregnancy at first-trimester scan, we can offer preventive treatment and there by prevent some of the severe complications of pregnancy such as severe PE its complications and also fetal growth restriction to some extent.

SCOPE OF FIRST-TRIMESTER SCREENING

The window of 11–13 weeks 6 days is the most crucial one with following arms:

- Aneuploidy screening
- Detection of structural anomalies
- Prediction of PE and fetal growth restriction

Aneuploidy Screening

The nuchal scan started with the aim of risk assessment of common aneuploidies such as trisomy 21, 18, and 13. Aneuploidy screening is possible with combination of ultrasound markers and biochemical markers.

The ultrasound markers are shown in **Figures 1 to 3**.

The biochemical markers are:

- β-hCG
- Pregnancy-associated plasma protein A (PAPP-A)
- After noninvasive prenatal screening (NIPS), the first trimester combined

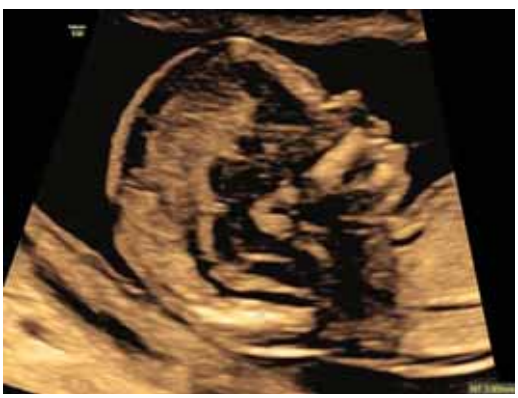


Fig. 1: Nuchal translucency and nasal bone.

screening (maternal age and history, gestational age, NT measurement, PAPP-A, and free beta-hCG) performed at 11^{+0}–13^{+6} weeks' gestation is the most robust screening test for fetal aneuploidy. For a positive rate of 3–5%, screening with the combined test can identify >90% of fetuses with trisomy 21. The detection rate (DR) of trisomy 18 and 13 is about 95% for the same false-positive rate.[9]

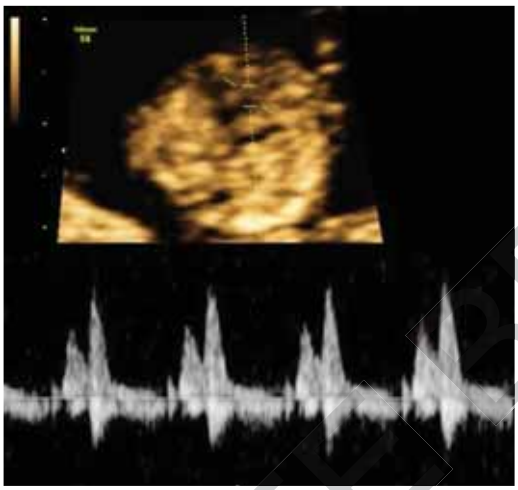


Fig. 2: Tricuspid flow.

Detection of Structural Anomalies

Due to advancement in ultrasound technology, better skill approximately 50–60% anomalies can be picked up at 11^{+0}–13^{+6} weeks scan. A thickened NT increases the risk of congenital fetal defects even in the absence of aneuploidy.[2]

There are nine major anomalies that are 100% detectable at first-trimester scan—(1) holoprosencephaly, (2) acrania, (3) encephalocele, (4) iniencephaly, (5) body stalk anomaly, (6) exomphalos, (7) gastroschisis, (8) megacystis, and (9) missing limb **(Figs. 4 and 5)**.[10]

Apart from these nine anomalies, also now many more anomalies can be picked up at first-trimester scan. The benefit of early detection of lethal/major anomalies is that if patient does not want to continue the pregnancy, it allows safe early termination.

Because the prevalence of structural anomalies is to the tune of 2–3%, it becomes even more important to be able to pick up many of them in first trimester which will help couple taking decision regarding continuation of pregnancy (in case of lethal anomalies), planning antenatal surveillance,

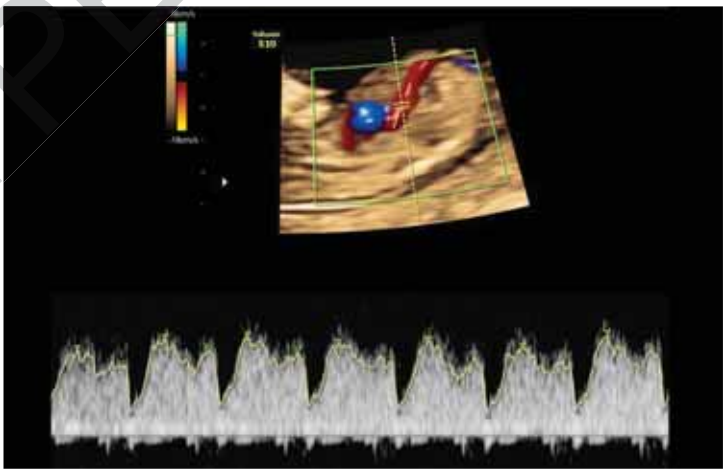
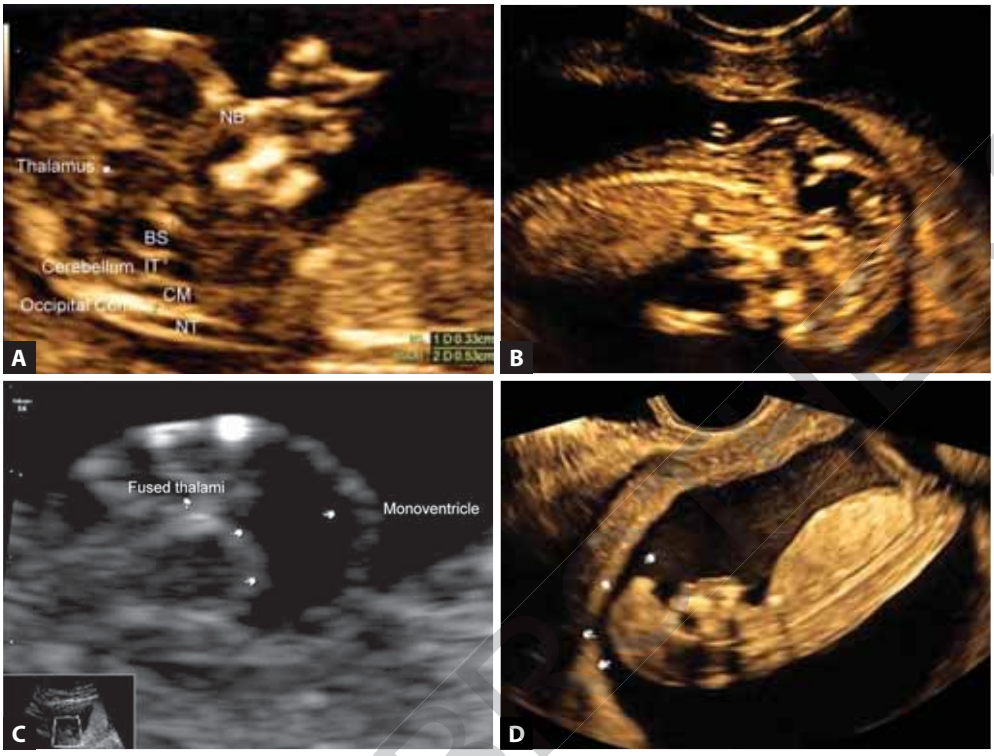


Fig. 3: Ductus venosus wave.



Figs. 4A to D: Intracranial translucency; encephalocele, holoprosencephaly, and acrania with exencephaly. (NB : nasal bone; BS: brainstem; IT: intracranial translucency; CM: cisterna magna; NT: nuchal translucency)

understanding the prognosis and deciding about place of delivery and possible postnatal care/treatment required. So, all in all it helps plan pregnancy and delivery better with better perinatal outcome.

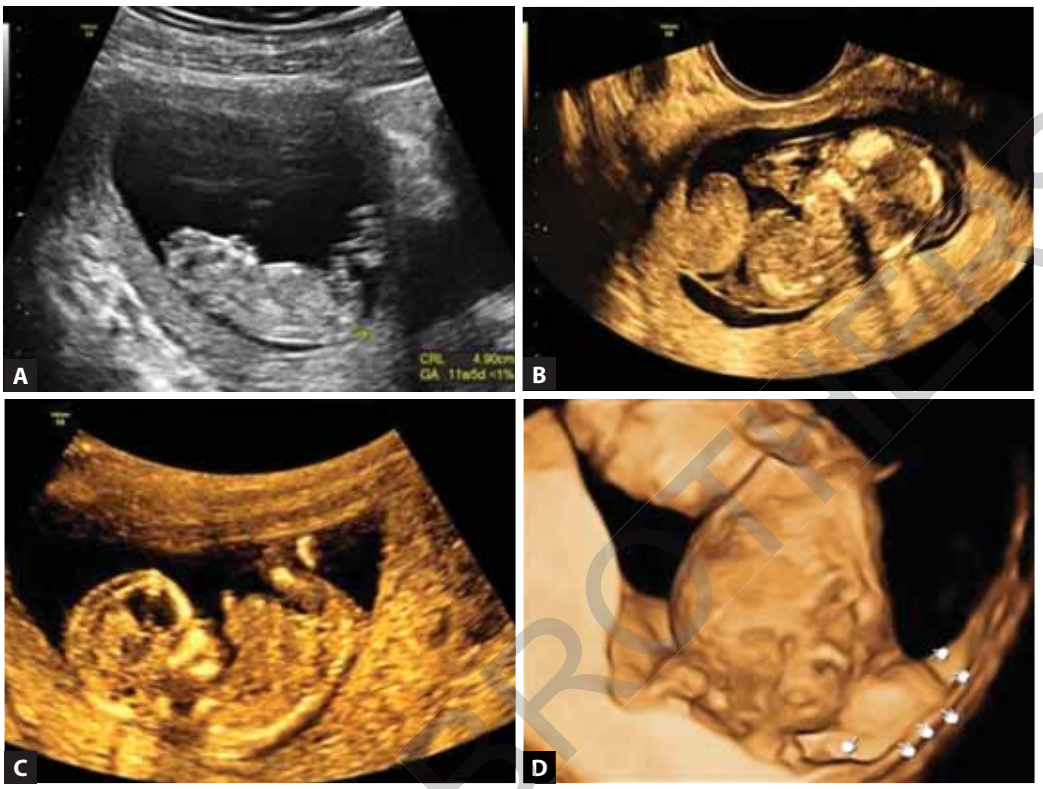
FIRST-TRIMESTER ASSESSMENT OF MULTIPLE GESTATIONS

In multiple gestation, it is utmost importance to differentiate between dichorionic and monochorionic pregnancy as the complications, monitoring, and management of each one is entirely different. As the 11^{+0}–13^{+6} weeks scan is a golden opportunity to decide about chorionicity, it must be decided at this scan. This is possible with two important signs. Lambda sign and T sign. The lambda sign is present in dichorionic twin due to chorionic tissue insinuating between two amniotic membranes as shown in **Figure 6**. The T sign is present in monochorionic twins as the amniotic membrane directly inserts on the placenta as shown in **Figure 7**.

Not only should lambda and T signs be seen at first-trimester scan but it is of paramount importance to document this in the report, save a soft copy and a hard copy should be given to the patient for future reference.

FIRST-TRIMESTER PREDICTION OF MATERNAL-FETAL COMPLICATIONS

Till now we have discussed about fetal aneuploidy and structural anomalies.



Figs. 5Ato D: (A) Acrania; (B) Limb body wall complex; (C) Omphalocele; (D) Meningocele.

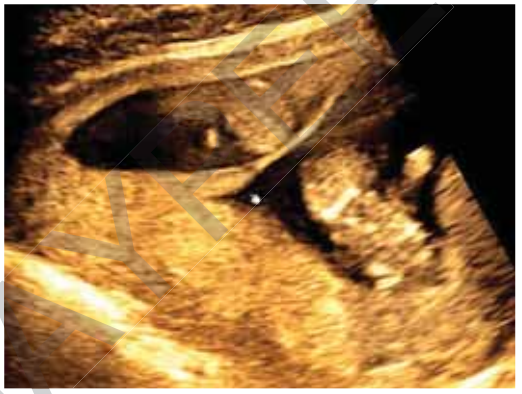


Fig. 6: Lambda sign

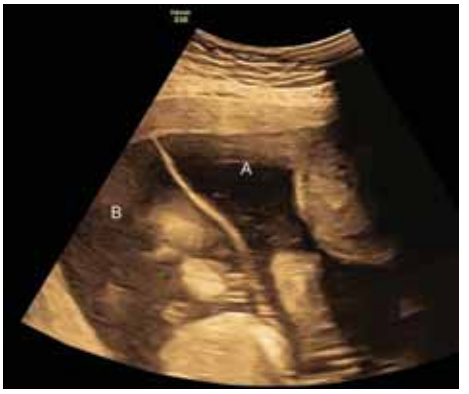
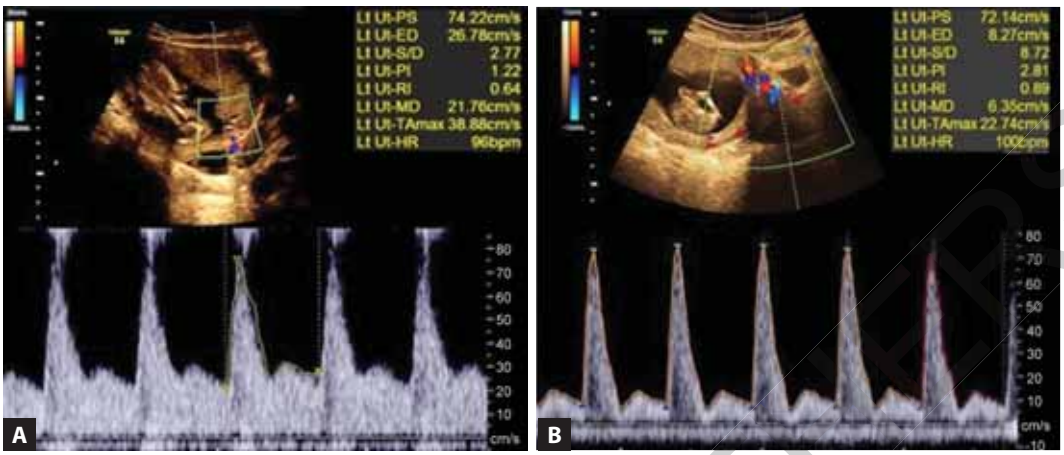


Fig. 7: T sign

However, maternal and fetal complications that are related to abnormal placentation are much more common than both of these problems combined.[2]

The second wave of trophoblastic invasion which is over by 16–17 weeks is of great importance for converting high resistance uterine artery to low resistance system of



Figs. 8A and B: (A) Normal uterine A waveform; (B) High uterine a pulsatility index.

pregnancy. Any deficiency in this leads to complications such as PE, fetal growth restriction, and stillbirth. And this forms the basis of predicting and preventing PE and fetal growth restriction.[5] This is possible with the help of maternal demographic factors, mean uterine artery pulsatility index (PI), PAPP-A, and placental growth factor (PlGF) are one of the most important aspect of first-trimester screening.[3,6]

Maternal Demographic Factors

- *Age:* >40 years
- *Racial origin:* Nordic, Black, South Asian, or Pacific Island
- *Height and weight:* Body mass index of 35 kg/m^2 or more at first visit
- *Mode of conception:* In vitro fertilization (IVF)
- *Smoking:* Reduces chance of PE
- *Medical history:* Diabetes mellitus (DM), chronic hypertension (HT), chronic renal disease, systemic lupus erythematosus (SLE), antiphospholipid antibodies (APLA)
- *Family history:* PE in mother/sister; family history of early-onset cardiovascular disease
- *Obstetric history:* PE (previous early-onset PE and preterm delivery at <34 weeks' gestation); pregnancy interval of >10 years; new partner

Uterine Artery Pulsatility Index

Mean of both uterine artery PI is taken and the multiples of the median (MoM) for a particular gestational age is used for risk calculation **(Figs. 8A and B)**.

Biochemistry

Abnormal placentation leads to reduction in:

- PAPP-A
- PlGF

A combination of biophysical and biochemical markers are superior to other tests for early prediction of the development of PE.[1,6]

As per ASPRE study, in combined first-trimester screening for preterm PE with a risk cut-off of 1 in 100, the DR was 76.7% for preterm PE and 43.1% for term PE, at screen-positive rate of 10.5% and FPR of 9.2%.[7]

Sensitivity of different markers for prediction of early PE (<34 weeks) at 11–13 weeks **(Table 1)**.[4]

TABLE 1: Sensitivity of different markers for prediction of early preeclampsia.

Markers	*Sensitivity*
MDF + MAP	51%
MDF + MAP + Ut A PI	75%
MDF + MAP + Ut A PI + PAPP-A	80%
MDF + MAP + Ut A PI + PAPP-A + PLGF	90%

(MAP: mean arterial pressure; MDF: maternal demographic factors; PI: pulsatility index; PLGF: placental growth factor)

Now once the patients who are at high risk for PE are identified, the next step would be preventing it.

Early prediction of PE at 11–13 weeks 6 days scan would allow for timely initiation of preventive therapy before the second phase of trophoblastic invasion (16 weeks).[7]

The ASPRE trial demonstrated that, in women with singleton pregnancy who were identified by means of first trimester combined screening as being at high risk for preterm PE (>1:100), the administration of aspirin at a dose of 150 mg per day from 11 to 14 weeks until 36 weeks' gestation reduces the incidence of preterm PE by > 60%.[7]

Even FIGO has strongly supported the ASPRE study by FMF regarding predicting and preventing PE.[8]

- Prophylaxis for women at high risk (>1:100)
- Aspirin for prevention of preterm PE
- Start between 11w0d to 14w6d
- ~150 mg every night until
- 36 weeks | Delivery | PE diagnosed
- Do not prescribe low-dose aspirin for all pregnant women.

CONCLUSION

So from the evidenced-based data we can very well see that the 11–14 weeks duration of pregnancy is a golden window to assess the risk for aneuploidies, find out many of the structural defects and assessing the risk for preeclampsia and placental insufficiency as well as making its use in preventing some of the most dreaded complications such as severe preeclampsia and associated complication.

So let us invert the pyramid of antenatal care, make the most use of this golden window of opportunity, and help our patients to improve their health and perinatal outcome.

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- Practice-oriented book with insight into the role of ultrasound in obstetrics and gynecology with contribution from eminent authors from all over India
- Useful to postgraduate students
- Guides practicing obstetricians and gynecologists to manage patients with various conditions better with the help of ultrasound.

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