

Basic of Ultra Sound

Dr. Yashodhara Pradeep

Professor

Dept. ObGyn

King George Medical University

Lucknow

2014

Basics of Ultra sound

- Ian Donald & Co –workers (1958)
- Two dimensional
- Doppler
- Three Dimensional
- Four Dimensional

Basics of Ultrasound

Physics:

- Piezoelectric crystals
- 40 frames/ second
- Real time
- High Frequency
- Low frequency
- Frequency 2-10 MHz

Basics of Ultrasound

Safety :

- Indication
- ALARA principle
(AIUM 2003)
- Safe: No confirmed damaging biological effects in mammalian tissue demonstrated in the frequency range of Medical Ultrasound (AIUM 1991)

Equipments

- Real time equipments.
- Abdominal / Vaginal US examination.
- Choice of the transducer frequency is a balance between penetration and resolution.
- For abdominal examination 3 – 5Mhz transducers, for vaginal scanning 5 – 7.5Mhz transducers.
- Doppler technology and Doppler flow should be used whenever needed.

Basics of Ultrasound

Clinical Applications :

- Dating of Pregnancy
- Improve in pregnancy outcome
- Prevention of Post-term deliveries
- Reduction in Induction of Labor
- Decrease in maternal morbidity and mortality
- Improve Neonatal Outcome --- decrease in perinatal loss
- Identification of fetal anomaly
- Depends on the skill of the Sonologist

Who should do it ?

- A physician who has completed the residency Programme in Radiology or Obstetric & Gynecology with a minimum of 3 months experience in Obst. & Gyn. USG evaluation.
- The training should include 1 month of supervised and documented training in established ultrasound unit.
- The training should include basic physics, technique, performances and interpretation.
- A physician should do at least 200 US examination during training, Before offering services as a physician competent in diagnostic US examination.

Documentation

- It is most essential for quality patient care
- Permanent record of the ultrasound images is must.
- Identification of normal structures for retrospective evaluation and comparison.
- If pathology is identified, the follow up scan will help the clinician to decide the course of the disease and response to the management.
- Standard terminology should be used to avoid confusion.

Indication First Trimester

- To confirm site of pregnancy
- To confirm viability of pregnancy
- Define causes of vaginal bleeding
- Evaluate pelvic pain
- Estimate Gest. Age
- Diagnose or evaluate multiple pregnancy
- Confirm cardiac activity
- Assist to chorionic villus sampling, embryo transfer, and localization and removal of IUCD
- Evaluate maternal pelvic masses or uterine abnormalities
- Evaluate gestational trophoblastic diseases

Indication Second and Third Trimester

- Estimation of Gest. Age
- Growth profile in 2nd & 3rd Trimester
- Vaginal bleeding
- Abdominal and pelvic pain
- Incompetent cervix
- Determination of fetal presentation
- Suspected multiple gestation
- Adjunct to amniocentesis
- Clinical discrepancy in uterine size
- Pelvic mass
- Suspected molar pregnancy
- Adjunct to cervical cerclage
- Suspected ectopic pregnancy
- Suspected fetal death
- Suspected uterine abnormality

Indication Second & Third Trimester

- Evaluation of fetal well being
- Fetal environment oligo or poly hydramnios
- Suspected abruptio placenta
- Adjunct to external cephalic version
- Preterm premature rupture of membrane or preterm labor
- Abnormal biochemical markers
- Follow up observation of identified anomaly
- Follow up evaluation of placental location or suspected placenta previa
- H/O Previous congenital anomaly
- Serial evaluation of fetal growth in multiple gestation
- Evaluation of fetal condition in late registrants for prenatal care
- Rule out Congenital malformations
- Biophysical , modified biophysical profile
- Doppler velocity to know the fetus at risk Umbilical A , Middle cerebral A , Fetal Aorta Ductus Venosus , Uterine A

Guidelines for Obstetric Ultrasound

- 1st trimester sonography
- 2nd trimester sonography
- Basic ultrasound or level I ultrasound
- Targeted ultrasound or level II ultrasound (18 – 20Wks)



Components of standard ultrasound examination

First trimester

- GS Location , embryo or
- Yolk sac identification
- CRL
- Cardiac activity
- Fetal number, including
- Number of amnions and chorions of multiples when possible
- Uterus, adnexa and culdesac evaluation

Second Trimester

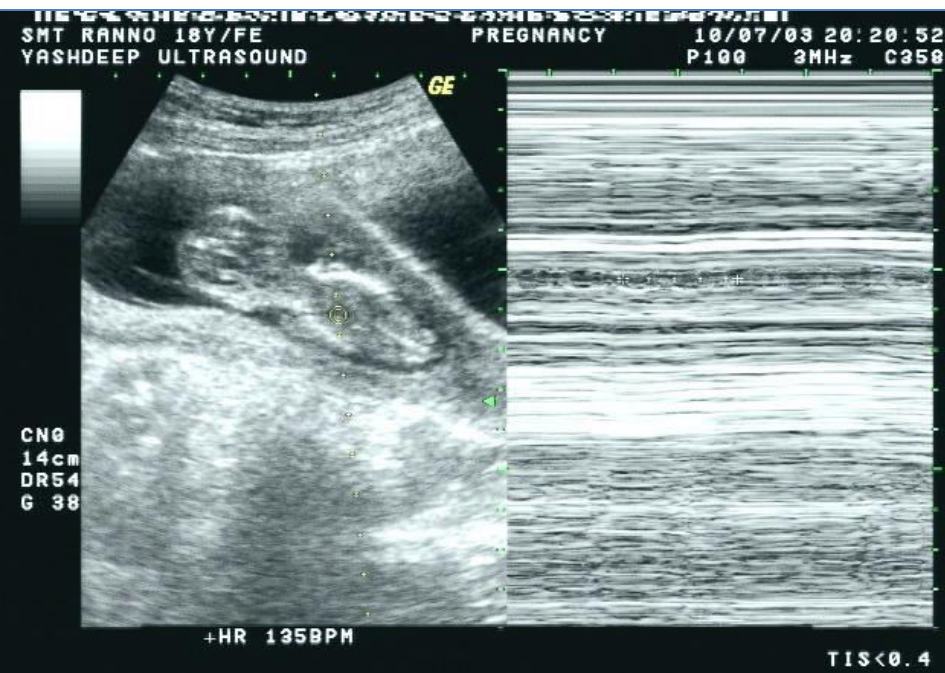
- Fetal number, presentation
- Fetal heart motion
- Placental location
- Amniotic fluid volume
- Gestational age assessment
- Fetal Weight estimation
- Evaluation for maternal pelvic masses
- Fetal anatomic survey

1st Trimester Sonography

Rule of Three

Every ultrasound examination should be done as per “**Rule of Three**.”

1. Pregnancy or no pregnancy
2. Intrauterine or extra uterine
3. Living or non living.



Intra Uterine Pregnancy – “Rule of Three”

1. Fetus – Single or multiple
2. Placenta – Single or more
3. Environment
4. – Fluid – Oligo – polyhydramnios.



Definite Diagnosis of Pregnancy

Rule of Three

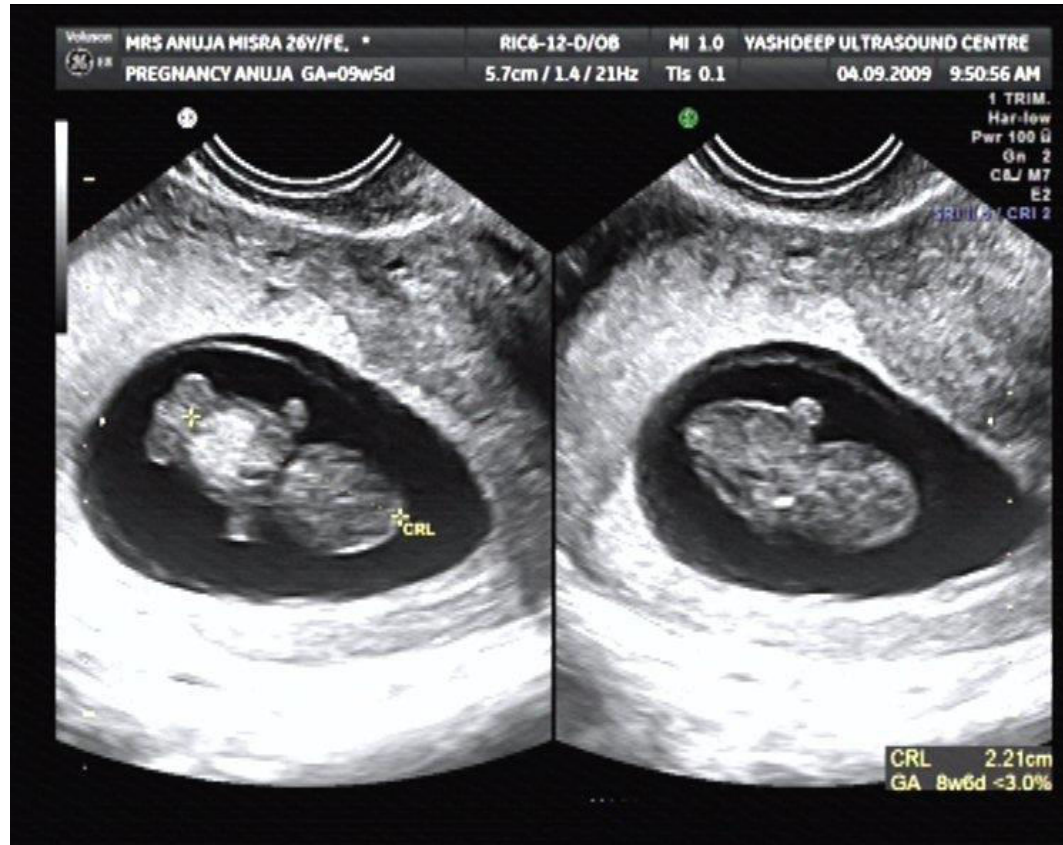
- Gestational sac – 5Wks single or multiple
- Double decidual sac sign
- Yolk sac – 5.5Wks



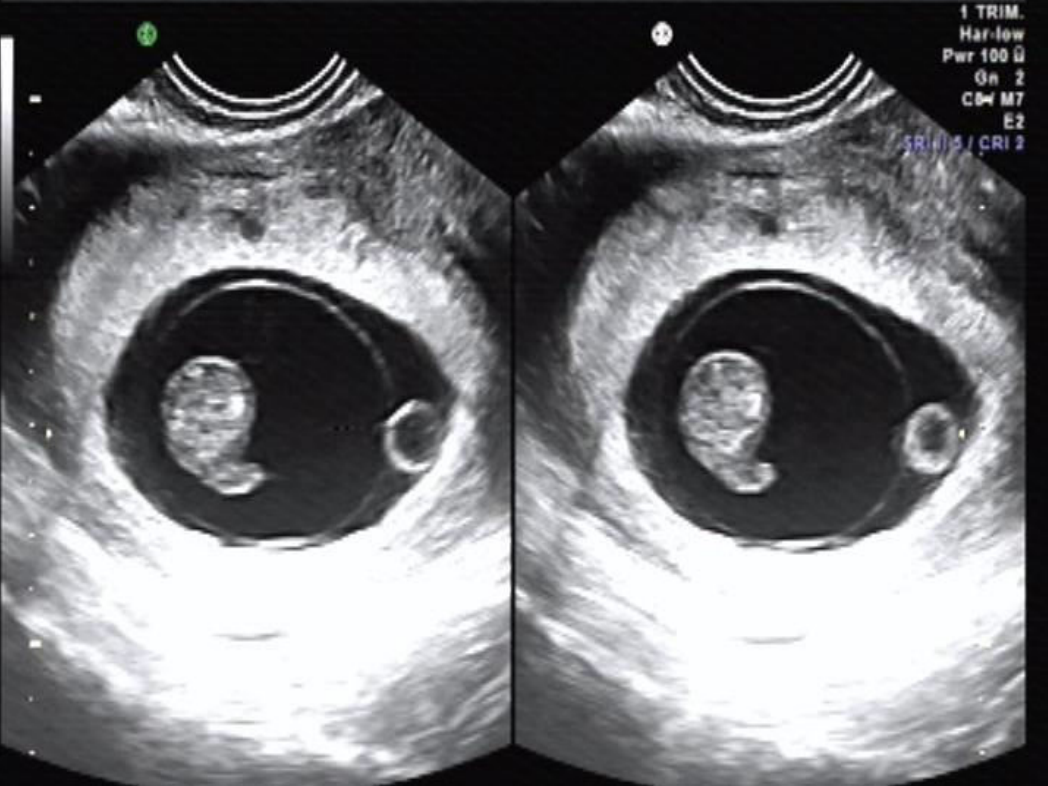
Dating of Pregnancy

Rule of Three

- Mean Sac Diameter (MSD) – 5Wks
- CRL – 5.5Wks
- Cardiac Activity – 5.5Wks
- $\text{MSD in mm} + 30 =$
Gestational age in days
- $\text{CRL in mm} + 42 =$
Gestational age in days
between 6 to 9.5Wks.



MRS ANUJA MISRA 26Y/FE. * RIC6-12-D/08 MI 1.0 YASHDEEP ULTRASOUND CENTRE
PREGNANCY ANUJA GA=09w5d 5.7cm / 1.4 / 21Hz TIs 0.1 04.09.2009 9:51:52 AM



1 TRIM.
Har-low
Pwr 100 0
On 2
CBW M7
E2
SRH 5 / CRI 2

AMNION CHORIONCAVITY

Adnexa

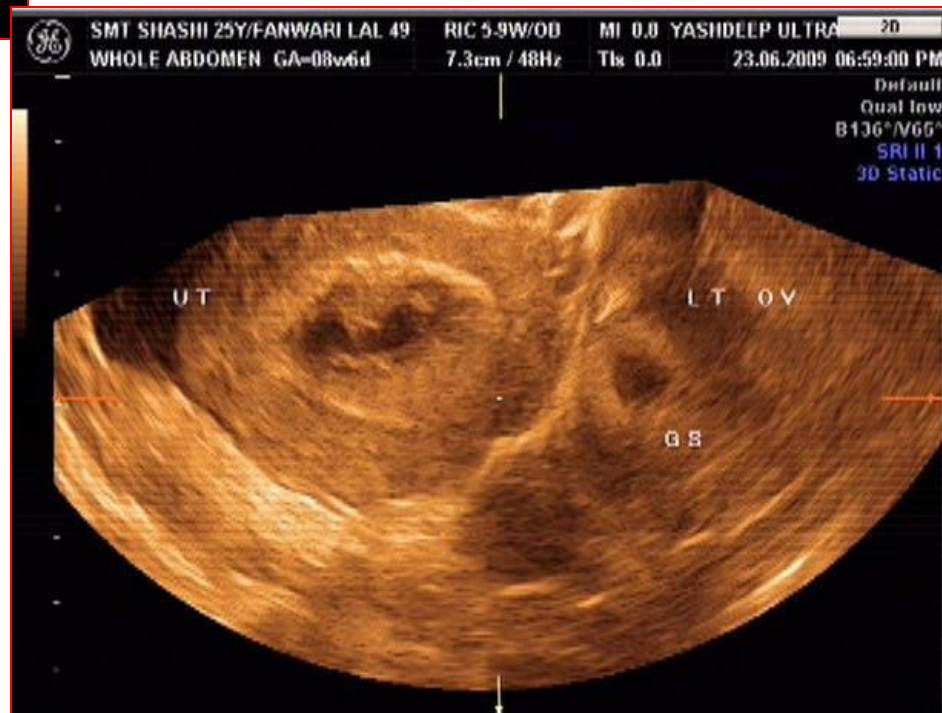
- Corpus luteum
- Presence of pelvic tumors, myoma, ovarian tumor or any other mass.
- Fluid in Cul-de-sac.





**HETEROTROPHIC
PREGNANCY**

**HETEROTROPHIC
PREGNANCY**



Guideline for IInd and IIIrd trimester ultrasound

2nd trimester USG – 15 – 24Wks.

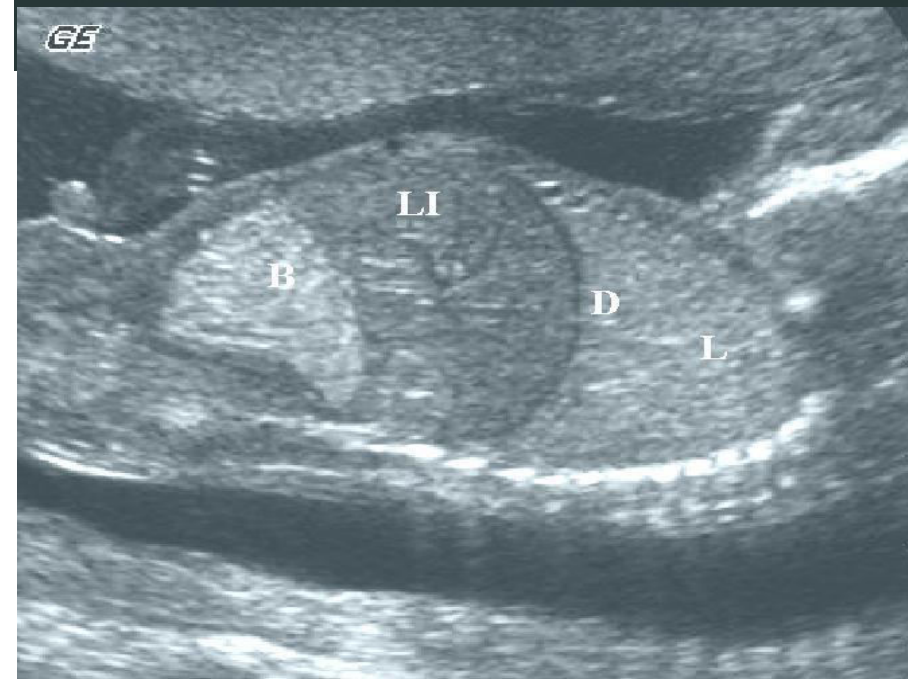
- Confirm fetal number
- Fetal presentation
- Fetal growth
- Fetal anatomy
- Placenta
- Environment
- – Fluid – Oligo – Polyhydramnios



BASICS OF OBSTETRICS ULTRASOUND

Ground Work

1. Systemic approach for examination.
2. Fetus examined from 'Head to Toe'.
3. Highest frequency optimized for fetal age.
4. Transverse & longitudinal scanning complete assessment of amniotic cavity, placental localization and fetal position.



Pregnancy – “Rule of Three”

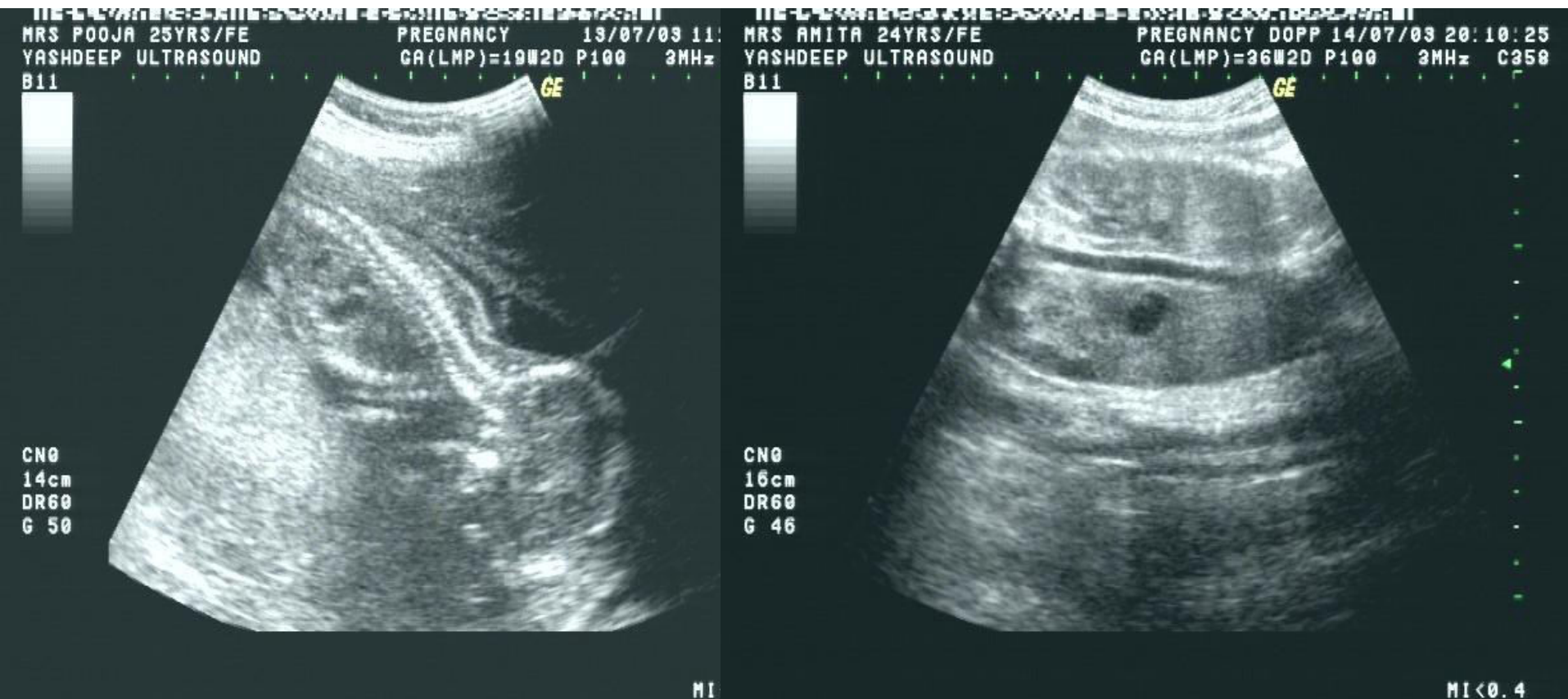
Fetus: Total examination from head to toe.

1. Head
2. Trunk
3. Extremities



Timings: -

- Second trimester examination from 15 – 18Wks.
- Maximum useful information about structural and chromosomal anomalies.



FETAL BRAIN

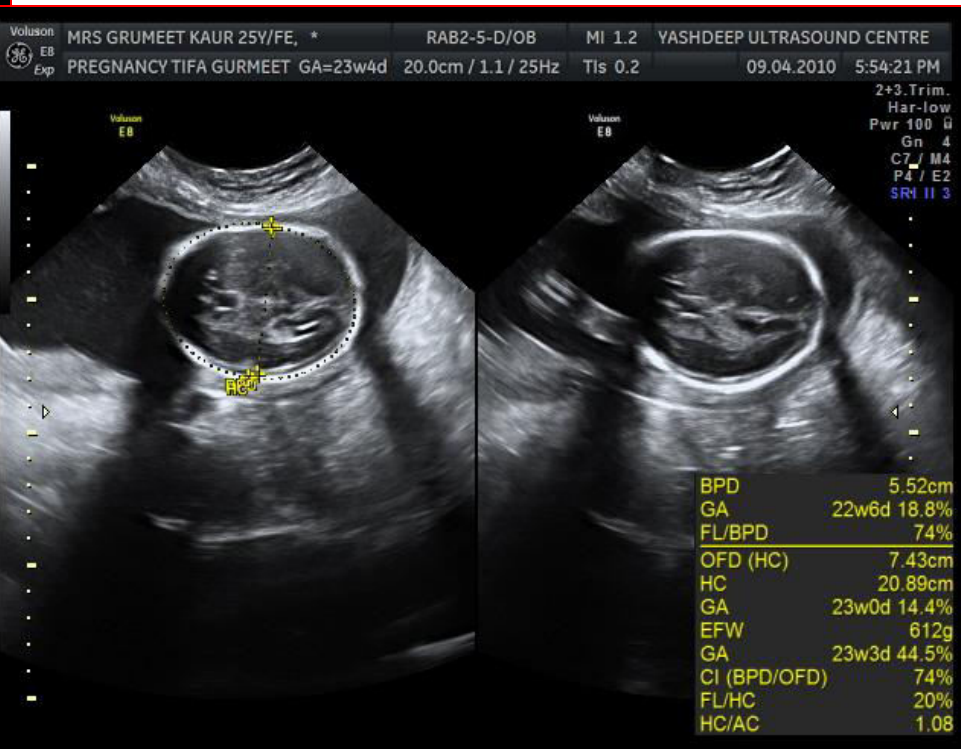
RULE OF THREE

- Transventricle View
- Transthalamic View
- Transcerebellar View





RULE OF THREE HEAD



Normal fetal anatomy

Fetal Head – “Rule of Three”

- Cranium
- Brain structures
- Space O.L.
- Normal view – Axial plane

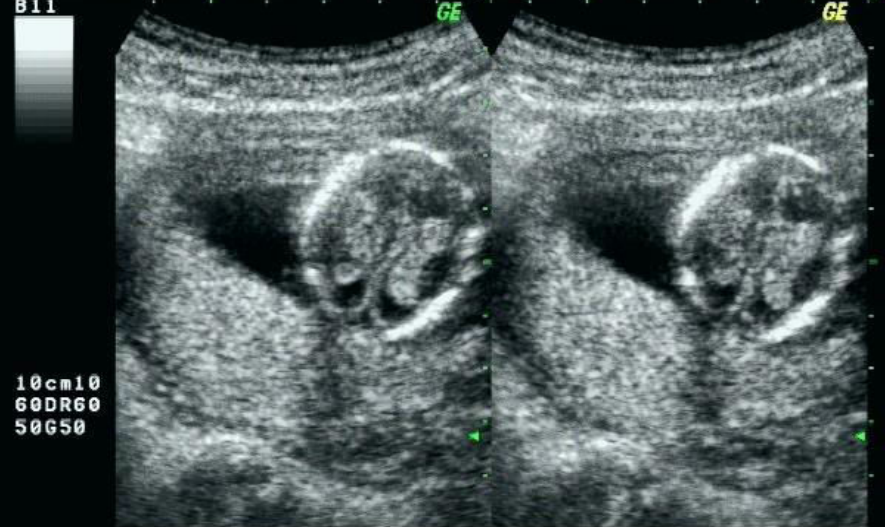


Fetal Head

MRS PREETI SRIVASTAVA 27Y/FE PREGNANCY 17/07/03 20:00:42
YASHDEEP ULTRASOUND GA(LMP)=14W6D P100 T4.5 C358



MRS PREETI SRIVASTAVA 27Y/FE PREGNANCY 17/07/03 20:00:53
YASHDEEP ULTRASOUND GA(LMP)=14W6D P100 T4.5 C358



MI=0.6

DR MRS JUGNU PREGNANCY 07/07/03 20:10
YASHDEEP ULTRASOUND GA(LMP)=31W3D P100 3MH=C



MI=0.6

MRS RUBY CHAUDHARY 26YR/FE ANENCEPHALY 20/07/02 18:52:42
YASHDEEP ULTRASOUND GA(LMP)=26W0D P100 3MH=C358



Recalled Image Not Current Patients

MI<0. Recalled Image Not Current Patients

MI<0.4

Fetal Spine – “Rule of Three”

- Parasagittal Three ossification centers: -
- Coronal 1. Anterior – Vert. Body
- Transverse 2. Posterior – lamina & pedicle

Any widening in posterior centers suggest neural tube defect.





SPINE RULE OF THREE



Fetal Spine

MRS NIDA TAQUEER 21YRS/FE PREGNANCY 16/07/03 17:45:33
YASHDEEP ULTRASOUND GA(LMP)=19W1D P100 4MHz C258



MRS NIDA TAQUEER 21YRS/FE PREGNANCY 16/07/03 17:46:24
YASHDEEP ULTRASOUND GA(LMP)=19W1D P100 4MHz C258



MRS MAHIMA TANDON 23YRS/FE PREGNANCY 17/05/03 18:53:16
YASHDEEP ULTRASOUND GA(LMP)=23W6D P100 3MHz C258



+ 14.7mm

MI<0.4

MRS MAHIMA TANDON 23YRS/FE PREGNANCY 17/05/03 18:54:20
YASHDEEP ULTRASOUND GA(LMP)=23W6D P100 3MHz C258



MI<0.4

Fetal Face – “Rule of Three”

Not a part of ‘Basic Examination’ planes

- Coronal
- Sagittal
- Axial



TIS<0.4

MI<0.4

Fetal Face



Fetal Thorax – “Rule of Three”

- Heart
- Lung
- SOL/FLUID



Fetal Abdomen – “Rule of Three”

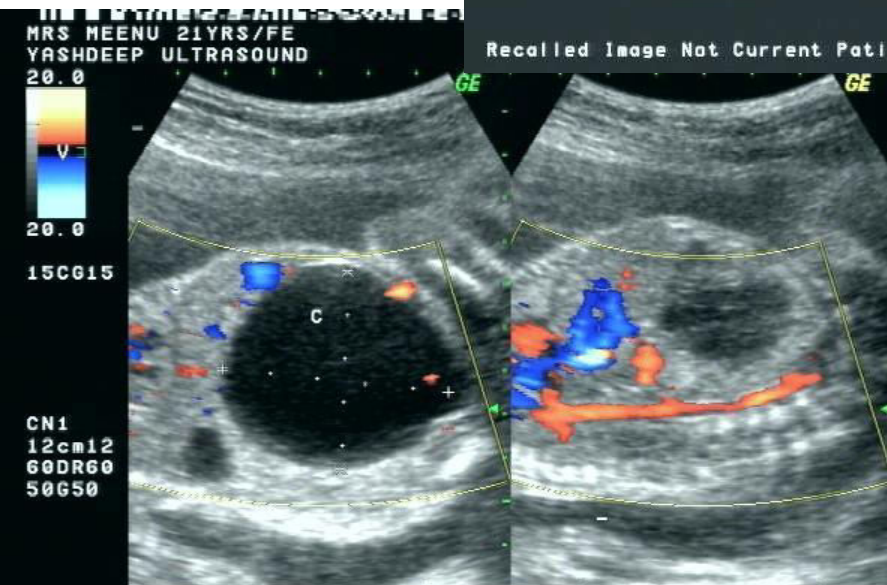
- Organs
- Vessels
- Fluid / mass



Recalled Image Not Current Patients

MI<0.4

2YRS/FE FETAL AORTA 15/02/03 19:47:09
GA(LMP)=20W0D P100 3MHz C358



+ 47.5mm × 45.7mm

TIS<0.4

Recalled Image Not Current Patients

TIS<0.4

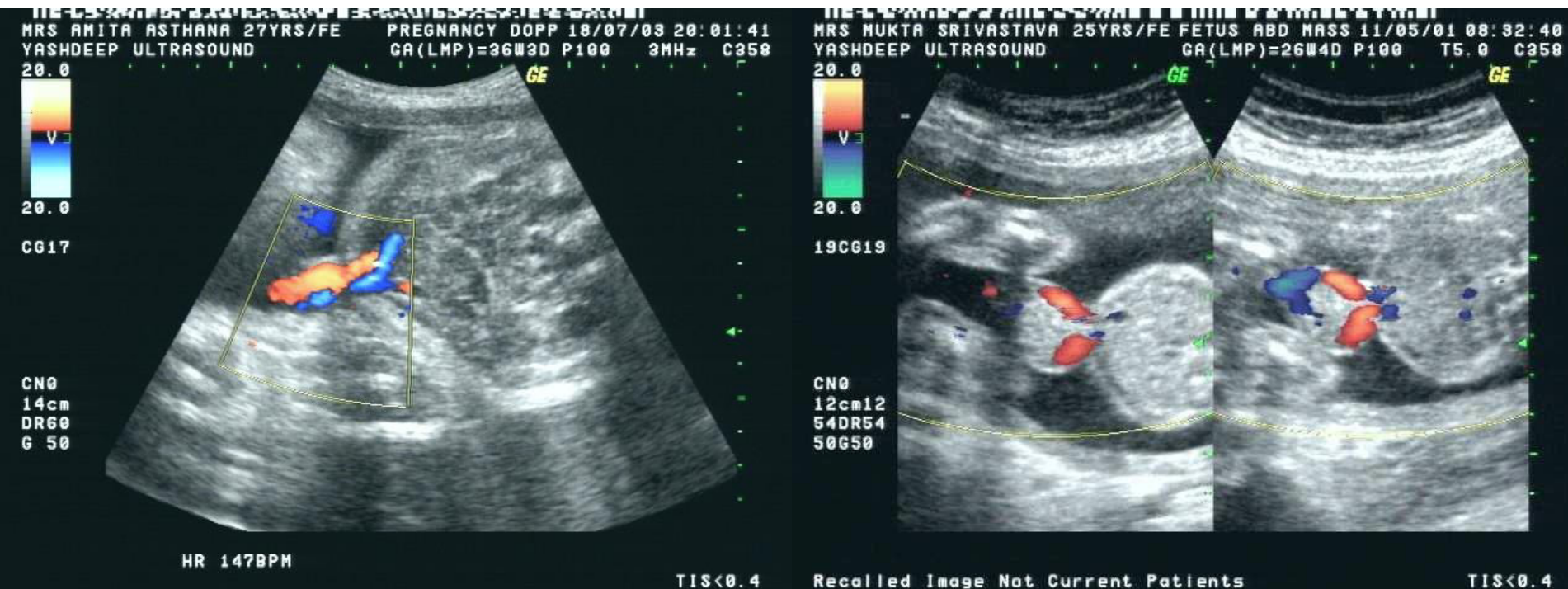
Fetal Urinary Tract

- Evaluation of urinary tract is important as common site of fetal anomalies.
- Kidneys bilateral hypoechoic para spinal organs with echogenic central renal sinus.
- Renal arteries can be seen on color doppler.
- Urinary bladder fluid filled shadow located low in the pelvis anteriorly.



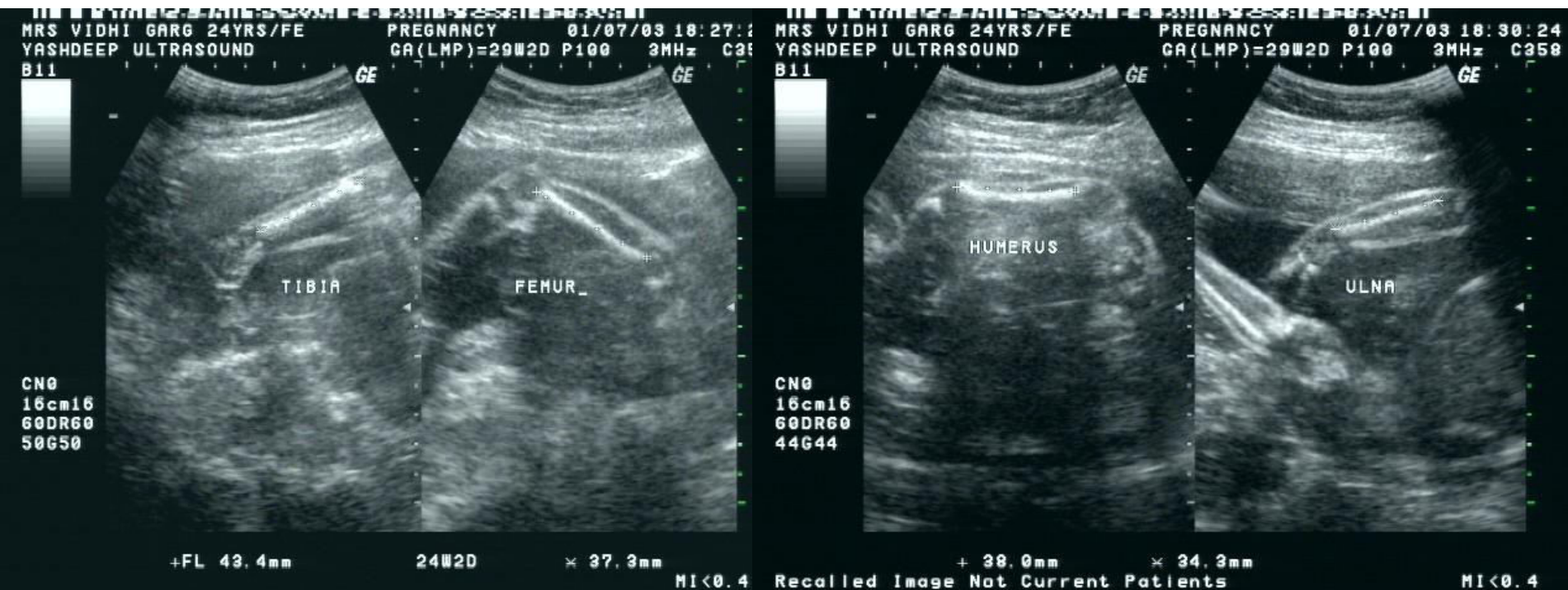
Anterior abdominal wall

- The site of the umbilical cord insertion is important to confirm a normal size cord.
- Visualization of normal cord insertion and anterior abdominal wall excludes ventral wall defects.



Extremities

- The bones of the extremities are easily seen.
- Femur is routinely measured for biometry. However, humerus, ulna, radius and fibula and tibia are also look for in skeletal dysplasia.



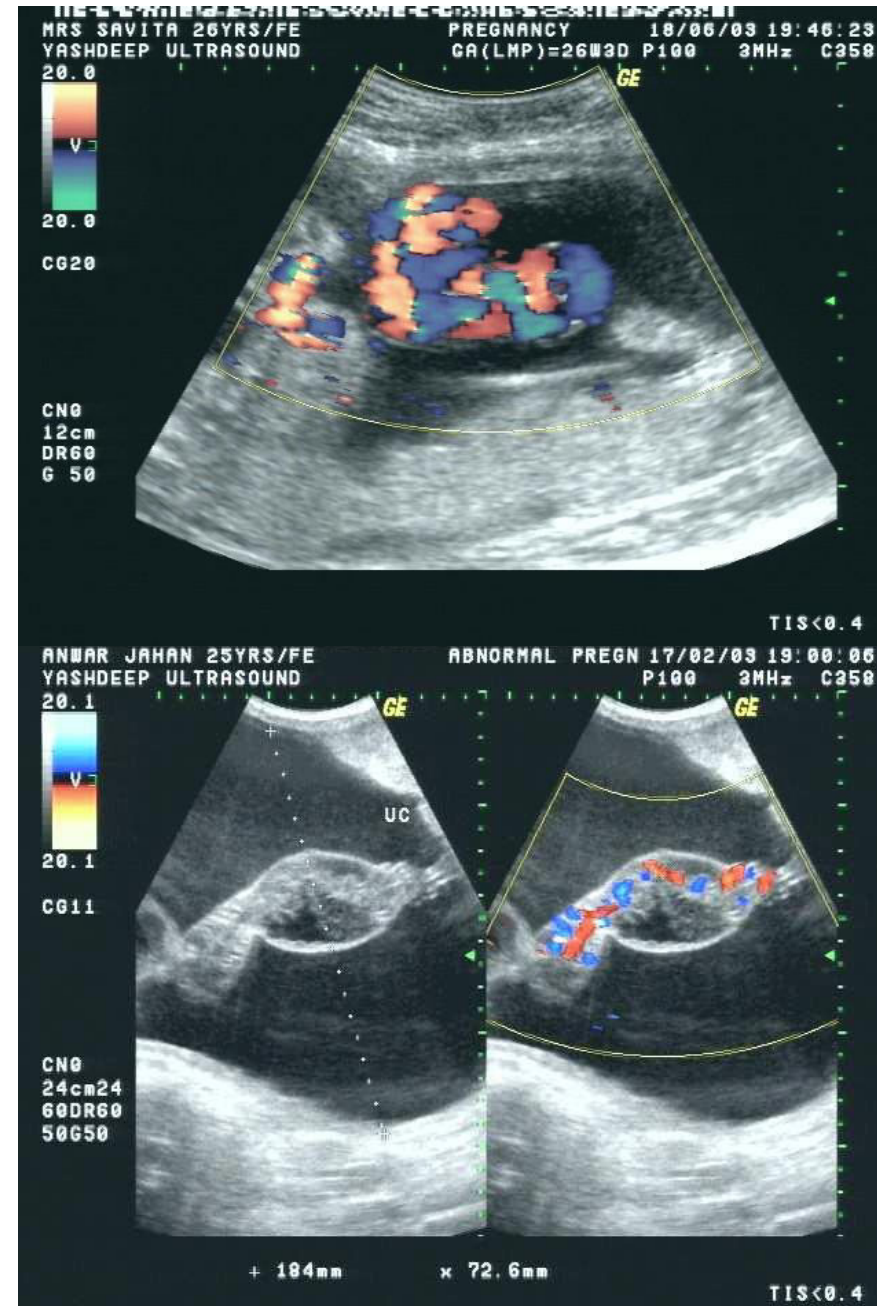
Extremities



Extremities

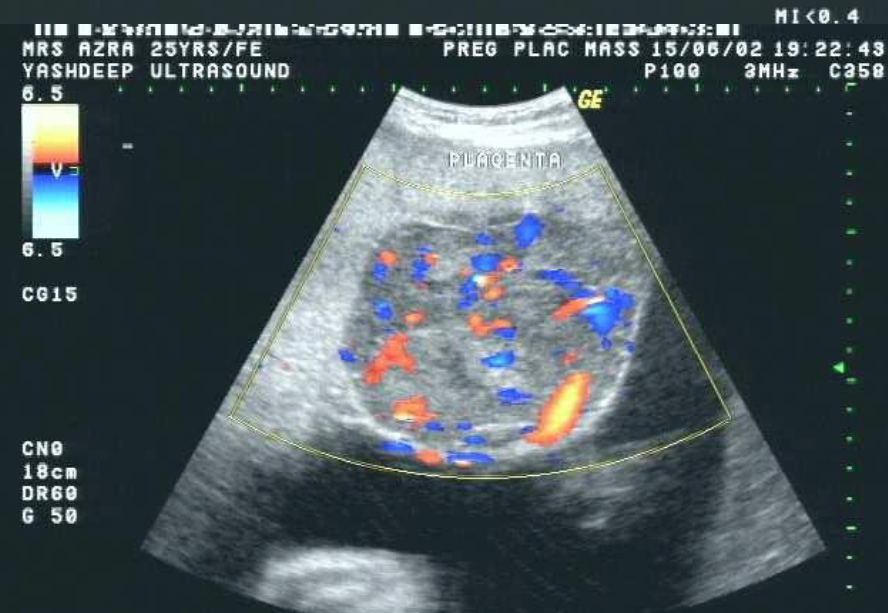
Umbilical vessels

- Normal three vessel cord may be confirmed by direct imaging of the cord.
- Two umbilical arteries and one umbilical vein.
- Arteries are smaller than vein.
- Single umbilical artery suggest chromosomal anomaly.



Placenta

- Evaluation of placenta is
- Part of routine examination.
- Site of placenta
- Type of placenta.
- Placental infarcts.
- Placental mass
- Placental abruption.



Placenta

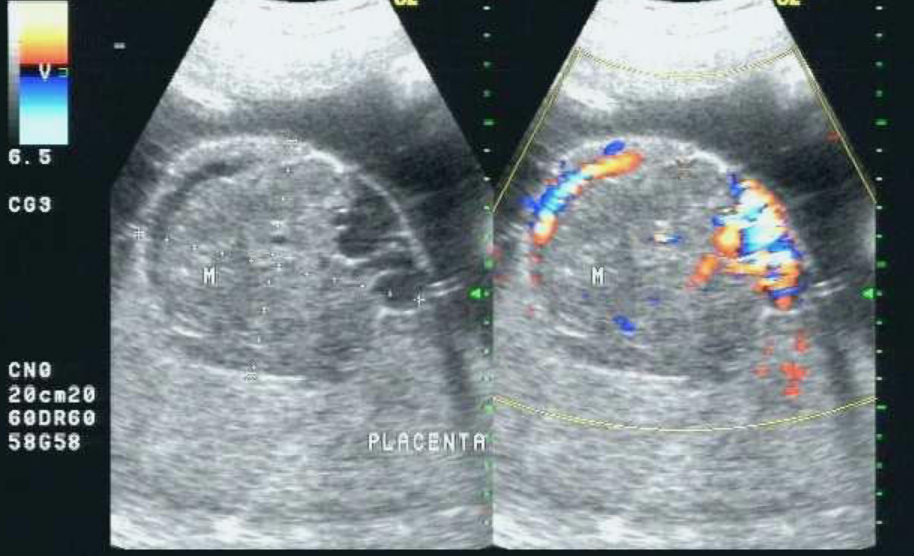
MRS AZRA 25YRS/FE
YASHDEEP ULTRASOUND
B11
PREG PLAC MASS 15/06/02 19:21:30
P100 3MHz C358



MRS KAGINI 25YRS/FE
YASHDEEP ULTRASOUND
B11
PREGNANCY DOPP 17/07/03 08:46:29
GA(LMP)=38W1D P100 3MHz C358



MRS AZRA 25YRS/FE
YASHDEEP ULTRASOUND
6.5
PREG PLAC MASS 15/06/02 19:42:37
GA(LMP)=32W5D P100 3MHz C358

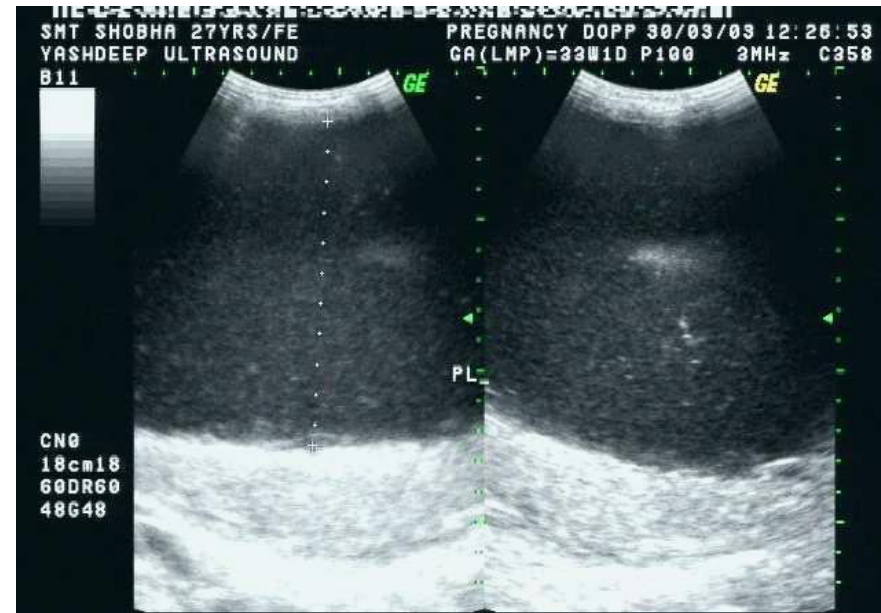


+ 100mm × 82.5mm × 58.9mm
Recalled Image Not Current Patients
TIS < 0.4

Recalled Image Not Current Patients
MI < 0.4

Amniotic fluid

- Amniotic fluid is important for fetal environment
- Abnormality of amniotic fluid known as oligoamnios and polyhydramnios.
- Oligoamnios – fluid pocket $< 2\text{cm}$, AFI < 5
- Polyhydramnios- Fluid pocket $> 8\text{cm}$ AFI > 20
- Abnormality of amniotic fluid suggest inherent maternal or fetal abnormality.



Fetal Biometry

○ Fetal biometry is important for fetal growth assessment.

○ The important biometric parameters are:

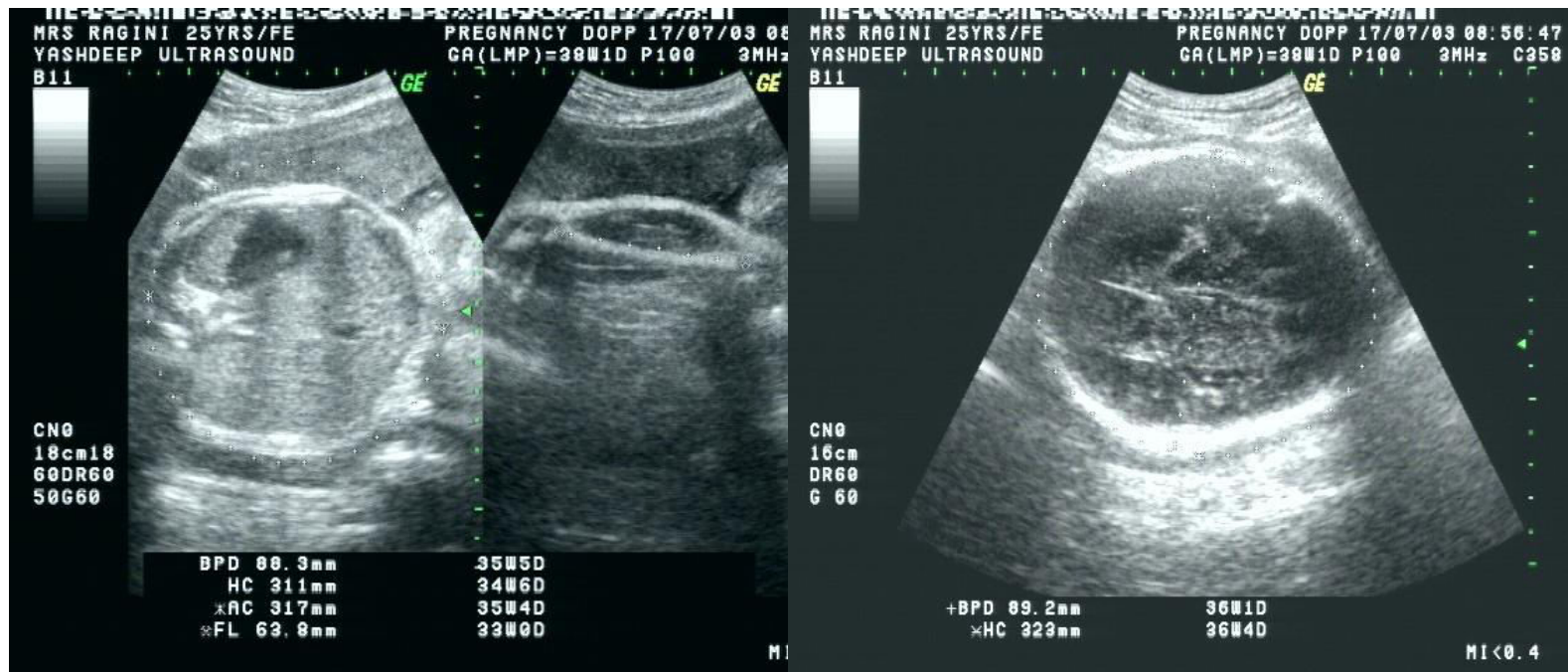
• CRL

• FL

• AC

• BPD

• HC



Limitations: -

- Maternal obesity
- Incomplete filling of UB.
- Early Gestational Age.
- Quality of Equipment.
- Experience of Sonologist.
- Fetal Position.
- Amount of Liquor.

Transabdominal (TA) Scanning

- Locating the ovaries in relation to the uterus, particularly those sited laterally
- Demonstrating large masses such as fibroid uterus, adnexal masses or pelvic collections
- Demonstrating iliac fossae, bladder & any associated renal pathology
- Demonstrating uterine anomalies, such as bicornuate uterus, which may be more difficult to appreciate on a TV scan

Indication of USG in gynecology

- Uterus –
 - Fibroids
 - Adenomyosis
 - Endometrial pathology
 - Hyperplasia
 - Polyp
 - Carcinoma
 - Pelvic inflammatory disease (PID)
 - Chronic endometritis
 - Oestrogen producing ovarian tumour
 - Postmenopausal atrophic endometritis

- Cervix –

- Chronic cervicitis

- Polyp

- Carcinoma

Q1

On Transvaginal Ultrasound ,the definite diagnosis of pregnancy is made by visualizing all except

- a. Gestational sac
- b. Beta hCG
- c. Double decidual sign
- d. Yolk Sac

Q2

The criteria for viable pregnancy on the T.V.S are all except

- a. Gestational Sac \geq 18mm
- b. Yolk sac
- c. Embryo \geq 5 mm in size
- d. Absent Cardiac activity

Q3

The presence of cystic hygroma on ultrasound in fetus is suggest all except

- a. Rh Isoimmunization
- b. Turner Syndrome
- c. Chromosomal aneuploidy
- d. Noonan Syndrome

Q-4

The all of the following features of Meckel – Gruber Syndrome except

- a. Cephalocele
- b. occipital midline defect
- c. Associated hydrocephalus
- d. Spina bifida

Q5

- On USG the diagnosis of Anencephaly can be made as early as gestational age in weeks
 - (a) 10
 - (b) 14
 - (c) 16
 - (d) 18

Q-5

The following are the features of Arnold-Chiari II Syndrome except

- a. Spina bifida
- b. Banana Sign
- c. Lemon Sign
- d. hydrocephalus

Thanks