Basic of Ultra Sound

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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.
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 2\textsuperscript{nd} & 3\textsuperscript{rd} 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 abnormaly
- 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
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
- MSD in mm + 30 = Gestational age in days
- CRL in mm + 42 = Gestational age in days between 6 to 9.5Wks.
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 II\textsuperscript{nd} and III\textsuperscript{rd} trimester ultrasound

2\textsuperscript{nd} trimester USG – 15 – 24WKs.

- Confirm fetal number
- Fetal presentation
- Fetal growth
- Fetal anatomy
- Placenta

- Environment
  - Fluid
  - Oligo
  - Polyhydramnios
**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 Spine – “Rule of Three”

- Parasagittal
- Coronal
- Transverse

Three ossification centers: -

1. Anterior – Vert. Body
2. Posterior – lamnia & pedicle

Any widening in posterior centers suggest neural tube defect.
SPINE
RULE OF THREE
Fetal Face – “Rule of Three”

Not a part of ‘Basic Examination’ planes

- Coronal
- Sagittal
- Axial
Fetal Face
Fetal Thorax – “Rule of Three”

- Heart
- Lung
- SOL/FLUID
Fetal Abdomen – “Rule of Three”

- Organs
- Vessels
- Fluid / mass
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
Umblical vessels

○ Normal three vessel cord may be confirmed by direct imaging of the cord.
○ Two umblical arteries and one umblical vein.
○ Arteries are smaller than vein.
○ Single umblical 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.
Amniotic fluid

- Amniotic fluid is important for fetal environment
- Abnormality of amniotic fluid known as oligoamnios and polyhydramnios.
  - Oligoamnios – fluid pocket < 2cm, AFI < 5
  - Polyhydramnios – Fluid pocket > 8cm, 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
QI

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 ≥ 18mm
b. Yolk sac
c. Embryo ≥5 mm in size
d. Absent Cardiac activity
The presence of cystic hygroma on ultrasound in fetus is suggest all except

a. Rh Isoimmunizition
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
The following are the features of Arnold-Chiari II Syndrome except

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