Level I Obstetrical Sonography:

The AIUM Standards

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Level I

• Standard
• Routine
• 2nd or 3rd trimester exam
• “Screening”

Level II

• Detailed
• Targeted
• Directed
• “High-risk”

Level I

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Level II

• Detailed
• Targeted
• Directed
• “High-risk”

www.aium.org
History of “Levels”

- MS-AFP screening program
- Level I: to detect obstetric problems
  - incorrect dates
  - multiple gestations
  - fetal demise
- Level II: to detect fetal anomalies
  - open NTD
  - abdominal wall defects

OB US Levels

The “level” of exam is predicated by the INTENT of the examination.

OB US Examination Practice Guidelines

History:
- ACR Commission on Ultrasound and AIUM
  - 1st established in 1986
- ACOG
  - Similar standard: 1988
  - Updated: 1993
- AIUM, ACR and ACOG
  - Published: 2003
  - Updated: 2007

AIUM Guidelines

- Goal:
  - Provide a minimum standard for all practitioners of obstetrical ultrasound
- www.aium.org
  - Practice Guidelines
    - Obstetric
Who should perform the OB US?

• ACR, AIUM, ACOG agree:
  “Specialty of the practitioner does not matter as long as the minimum standards are met.”

Practitioner Requirements

• Residency:
  – 3 mos diagnostic US in area practiced
  – Involved in at least 300 sonograms

  OR

• Evidence of 100 AMA PRA Category 1 Credits
• Involved with at least 300 sonograms within a 3 yr period in specialty practicing

Equipment Specifications:

• Real-time
  – Cardiac activity
  – Active movement
• Lowest possible exposure settings (OB settings)
• Transabdominal +/- transvaginal +/- transperineal
• Transducers:
  – TA: 3 – 8 MHz
  – Transvaginal: 5 – 10 MHz

Documentation:

• Require a permanent record of images to include:
  – All appropriate areas, both normal and abnormal
  – Variations from normal size accompanied by measurements
  – Side (right or left) of the anatomic site imaged
  – All labeled with:
    • Date of exam
    • Patient ID
    • Facility ID
Documentation:

- Require a permanent record of the interpretation:
  - Written or electronic
  - Stored and available in medical record

- Retention of the US exam (images and report) “should be consistent with the clinical needs and with relevant legal and local health care facility requirements”

Documentation:

- Require a written or electronic request
  - Sufficient information to allow for the appropriate performance and interpretation
  - Must be originated by:
    - A physician, other licensed HCP
    - OR someone under their direction
  - Accompanying clinical information provided by:
    - A physician or HCP familiar with clinical situation

Fetal Safety

- Generally considered safe
- Performed only when
  - valid medical indication
  - lowest possible exposure settings under ALARA principle
- No confirmed biologic effects on patients and their fetuses

Fetal Safety

- “The promotion, selling, or leasing of ultrasound equipment for making ‘keepsake fetal videos’ is considered by the US FDA to be an unapproved use of a medical device. Use of a diagnostic US system for these purposes may be in violation of state laws and regulations.”

  AIUM Guidelines, June 4, 2003
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AIUM Guidelines, June 4, 2003

Classification of Fetal Sonographic Examinations

- 1st Trimester
- Standard 2nd or 3rd Trimester
- Limited
- Specialized

Limited Examination:

- Appropriate only when a complete exam is on record
- Specific question requires investigation
  - cardiac activity in a bleeding pt
  - presentation in a laboring pt
  - re-evaluation of fetal size or interval growth
  - re-evaluate abnormalities previously noted

Specialized Examinations

- A detailed anatomic examination when an anomaly is suspected based upon:
  - history
  - biochemical abnormalities
  - results of a standard or limited exam
- Fetal Doppler
- Biophysical profile
- Fetal echocardiogram
- Additional biometric measurements
1st Trimester Ultrasound Examination

(1 week to 13 weeks, 6 days)

1st Trimester Indications

• 12 indications:
  – Confirm IUP
  – Suspected ectopic
  – Vaginal bleeding
  – Confirm cardiac activity……..

• 2 most recent additions:
  – Assess for certain fetal anomalies such as anencephaly in high-risk patients
  – To measure nuchal translucency (NT) when part of a screening program for fetal aneuploidy

1st Trimester Guidelines

• Overall Comment
  – Scanning in the first trimester may be performed either transabdominally or transvaginally. If transabdominal examination is not definitive, a transvaginal scan or transperineal scan should be performed whenever possible.
**1st Trimester Guidelines**

6 components:
1. Gestational sac, yolk sac, embryo and measurements
2. Cardiac activity
3. Embryonic/fetal number
4. Embryonic/fetal anatomy
5. Uterus, cervix, adnexa and cul-de-sac
6. Nuchal region

Embryo = < 11 weeks
Fetus = ≥ 11 weeks

**1st Trimester: #1**

- **Gestational Sac**
  - Presence, location and measurement
  - MSD = L+W+H (mm)
  \[ \frac{3}{3} \] (* MSD + 30 = GA (days)

- **Yolk sac**
  - Thin ring
  - < 6 mm

**1st Trimester: #1**

- **Embryo**:
  - Measure crown-rump length
  - Avg of 2-3

- **NOTE**:
  - Measure only what is most developed:
    - Biometry over CRL over MSD
Gestational Age

- **Sonographic age**: Size
  - Based on measurements (MSD, CRL, biometry)
  - Standardized to equate with menstrual age

- **Menstrual = clinical = LMP age**: Dates
  - Based on LNMP (assumes a 28 day cycle)
  - Conceptual (fetal) age + 14 days

- Size dates comparison
  - 1st trimester: +/- 7 days = WNL

1st Trimester: #2

- Presence or absence of cardiac activity:
  - Present = Living ≠ Viable
  - Absent:
    - ≥ 5 mm CRL = demise
    - < 5 mm CRL, consider f/u

  **TIP**: Normal embryo grows ≈ 1 mm/day

1st Trimester: #3

- Embryonic/Fetal #

- Chorionicity/Amnionicity
1st Tri: Chorionicity and Amnionicty

- Di/Di
- Mono/Di

Caution: subchorionic hemorrhage
# yolk sacs = # amnions

1st Trimester: #4

- Embryonic/fetal anatomy appropriate for the 1st trimester should be assessed.
  - Refers to GROSS anatomy

1st Trimester: #5

- Evaluation of the uterus, cervix, adnexal structures & cul-de-sac
  - Leiomyomata
    - size of largest
    - those potentially clinically significant

1st Trimester: #6

- Nuchal region
  - “If possible, the appearance should be assessed where a live fetus is present.”
  - If abnormal, refer to an NT lab
Nuchal Translucency Measurement

- 11-14 weeks
- Mid-sagittal plane
  - Head, neck, upper thorax, neutral position
  - Identify amnion
- Electronic calipers
  - Inner borders of widest space
  - Perpendicular to long axis

2nd and 3rd Trimester Ultrasound Examination

2nd & 3rd Trimester Indications

- 27 indications:
  - Estimation of gestational age
  - Evaluation of fetal growth
  - Vaginal bleeding
  - Pelvic pain
  - Abnormal biochemical markers….

- 4/27 indications refer to fetal anomalies:
  - 2 new, plus….
  - Follow-up evaluation of a fetal anomaly
  - History of a previous congenital anomaly

- Only 4/27 indications refer to fetal anomalies:
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2nd & 3rd Trimester Indications

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  - 2 new, plus….
  - Follow-up evaluation of a fetal anomaly
  - History of a previous congenital anomaly

- Of surveyed patients¹:
  - 89% Moms
  - 84% Partners
  ....believed the purpose of their OB exam was to look for fetal anomalies


2nd & 3rd Trimester Guidelines

7 components:
1. Fetal cardiac activity, number, presentation
2. Amniotic fluid volume
3. Placenta and cord
4. Gestational age assessment
5. Fetal weight estimation
6. Maternal anatomy
7. Fetal anatomy

2nd & 3rd Trimester: #1

- Fetal cardiac activity
  - Is it living?
  - Report abnormal heart rate or rhythm
  - Tachycardia: 220-230 bpm

2nd & 3rd Trimester: #1

- Fetal cardiac activity
  - Is it living?
  - Report abnormal heart rate or rhythm
  - Tachycardia: > 220 bpm
  - Bradycardia: < 95 bpm
2nd & 3rd Trimester: #1

- Fetal number
  - Multiple gestations:
    - Chorionicity & amnionicity
    - Comparison of fetal size
    - Estimation of amniotic fluid volume on both sides of the membrane
    - Fetal genitalia (when visualized)

Chorionicity and Amnionicity

In Order…..

- Count placental masses
  - Two: Dichorionic
  - One: Monochorionic or Dichorionic “fused”
- Evaluate genitalia
  - Opposite: Dichorionic
  - Same: Mono or Di
- Assess membrane
  - Thick, “twin-peak” sign: Di
  - Thin, “T” sign: Mono
  - None: Mo/Di or Mo/Mo

Membrane Assessment

- Membrane thickness
  - Subjective
  - Technical considerations
    - Progressively thins
- Intersection w/ placenta

Membrane Assessment

- Membrane thickness
  - Subjective
  - Technical considerations
    - Progressively thins
- Intersection w/ placenta
  - “Twin-peak” sign
  - “T” sign
No Membrane?

• Mono/Di
  – Statistically much more likely
  – “Stuck-twin” phenomenon
    • TTT
    • Oligo for 1 twin
• Mono/Mono
  – Cord entanglement diagnostic

Fetal Position

Lie: axis

Longitudinal
Transverse

Presentation: presenting part

cephalic vertex
breech
fetal head on maternal right or left

2nd & 3rd Trimester: #2

• A qualitative or semi-quantitative estimate of amniotic fluid volume

Methods:
  – Subjective / qualitative ← BEST
  – Single deepest pocket
  – Amniotic fluid index (AFI)
  – 2-diameter pocket

Amniotic Fluid Volume

Oligohydramnios
Polyhydramnios

TIPS: “Variable” presentation
- AC does not fill uterine cavity
Amniotic Fluid Volume #'s

- **Single pocket method:**
  - < 2cm = oligo
  - > 8cm = poly
- **Amniotic fluid index**
  - < 5 cm = oligo
  - > 20-24 cm = poly
- **2 diameter pocket**
  - <1 cm in two perpendicular planes

AFV Measurement

- **TIPS:**
  - Same orientation in all quadrants
  - No cord or fetal parts between calipers
  - Always use color Doppler

2nd & 3rd Trimester: #3

- **Placenta and Cord:**
  - Placental
    - Location
    - Appearance
    - Relationship to internal cervical os
  - Umbilical cord:
    - Number of vessels
Placental Appearance

- Maturity
- Hemorrhage
- Masses/Gestational Trophoblastic Dz
- Invasion
- Structural variants

Gr 0 = smooth
Gr I = few Ca ++ (30wks)
Gr II = basal stippling (34wks)
Gr III = Ca++d cotyledons
  - Rare < 36 wks
  - More common: smokers
  - Assoc. with placental insufficiency

Placental Edge Relative to Cervix

- Complete previa
  - covers internal cervical os
- Marginal previa
  - comes to the internal cervical os
- Low-lying placenta
  - within 2 cm of internal cervical os

Incomplete or partial previa is a clinical dx
Placenta Previa Pitfalls

- Kissing Contractions
- Over distended UB

Placental Edge Relative to Cervix

- CAUTION:
  - Definitions vary
    - Distance from lip, os?
    - Best to also be descriptive and detailed
  - Do not hesitate to evaluate endovaginally
  - Beware of pitfalls:
    - #1 misdiagnosis in pregnancy!
Placenta Previa Pitfalls

- Kissing Contractions
- Over distended UB
- Fetal hair
- Too early in gestation (< 17 wks)
  - May resolve with preferential stretching of LUS

Umbilical Cord: # of Vessels

- May miss up to 16% of 2 VC’s
- 30% assoc. anomalies

Umbilical Cord: # of Vessels

May consider axial view in fluid

2nd & 3rd Trimester: #4

- Assessment of mean gestational age
  - Biparietal diameter
  - Head circumference
  - Femoral diaphysis length
  - Abdominal circumference (or average abdominal diameter)
2nd & 3rd Trimester: #4

Comment:
- Discrepancies with menstrual age may suggest a growth abnormality, IUGR, macrosomia
- Variability increases with advancing pregnancy

- Size ≠ dates if +/- :
  - 10 - 14 days in 2nd tri
  - 14 - 21 days in 3rd tri
  S>D or S<D

Biparietal Diameter (BPD)

- Symmetric calvarium
- Level of thalami, cavum septum pellucidi, choroid in antrum

- Measure: outer –to-inner

NOTE: If shape abnormal, HC more reliable

Head Circumference (HC)

- Same level as BPD

- Measure: ellipse of outer perimeter of bony calvarium, excluding soft tissues of scalp

Abdominal Circumference (AC)

- Symmetric ribs, junction of umbilical vein/portal sinus, stomach (when visible)

- Measure: ellipse of outer perimeter including soft tissues
**Femoral Diaphysis Length (FL)**

- Upside femur
- Long axis, hypoechoic epiphyses in view
- Measure:
  - length, end-to-end
  - avoid the distal femoral point

**TIP:** If abnormal, use linear transducer and measure both

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**2nd & 3rd Trimester: #5**

- Fetal weight estimation
  - Biometric data with AC most heavily weighted
  - If prior studies available, must assess interval growth using the earliest exam
  - COMMENT: "..pregnancy should not be re-dated after an accurate earlier scan has been performed..."

- To assess ongoing growth, suggest 2 - 4 wk interval
- ±15% known variability with actual birth weights
Trust Your Vaginal Ultrasound

Measure residual closed cervix!

2nd & 3rd Trimester: #7

- Fetal anatomy:
  - May adequately be assessed after 18 wks GA
  - Limitations of the exam should be documented:
    - Fetal size, position, movement
    - Abdominal scars
    - Increased maternal wall thickness
    - Artifacts from acoustic shadowing
  - The following areas represent the essential elements of a standard examination of the fetus:

Fetal Anatomy

i. Head, face and neck
   - Cerebellum
   - Cisterna magna
   - Choroid plexus
   - Lateral ventricles
   - Midline falx
   - Cavum septum pellucidi
   - Upper lip
   - Nuchal thickness

ii. Chest
   - 4 chamber heart
   - Outflow tracts

iii. Abdomen
   - Stomach
   - Kidneys
   - Urinary bladder
   - Cord insertion site
   - Umbilical cord vessel #

iv. Spine

v. Extremities

vi. Sex

Fetal Anatomy: Head, Face, & Neck

i. Head, face and neck
   - Cerebellum
   - Cisterna magna
   - Choroid plexus
   - Lateral ventricles
   - Midline falx
   - Cavum septum pellucidi
   - Upper lip
   - Nuchal thickness
Comment: Nuchal Thickening

- “A measurement of the nuchal fold may be helpful during a specific age interval to suggest an increased risk of aneuploidy.”
  - Level PF & CSP
  - Outer calvarium to outer skin
  - 18 – 21 weeks: < 6 mm
  - Caution: “pseudo-thickening”

Fetal Anatomy: Chest

ii. Chest
  - Heart:
    - 4-chamber view
    - Axis
      - Only RA (little of RV) to right of midline
      - 45° axis

Sensitivity for CHD: 48%

Fetal Anatomy: Chest

ii. Chest
  - If technically feasible, outflow tracts should be attempted
    - RVOT
    - LVOT

Sensitivity for CHD by adding OFTs: 78%

Fetal Anatomy: Abdomen

iii. Abdomen
  - Stomach: presence, absence, situs
  - Kidneys
  - Urinary bladder
  - Fetal umbilical cord insertion site into the fetal abdomen
Fetal Anatomy: Spine

iv. Spine
- Cervical
- Thoracic
- Lumbar
- Sacral
  - Long and transverse

Fetal Anatomy: Extremities

v. Extremities
- Legs and arms
  - Presence or absence

Vague wording
Lower: thigh vs. leg?
Upper: arm vs. forearm?

Fetal Anatomy: Sex

vi. Sex
- Genitalia
- Medically indicated in low-risk pregnancies for multiple gestations only

TIPS: Respect parents wishes to know
If saving an image, make sure it looks normal

AIUM Practice Guideline for the Performance of OB US Examinations

“While it is not possible to detect all structural congenital anomalies with diagnostic ultrasound, adherence to the following guidelines will maximize the possibility of detecting many fetal abnormalities”
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"While it is not possible to detect all structural congenital anomalies with diagnostic ultrasound, adherence to the following guidelines will maximize the possibility of detecting many fetal abnormalities."

What Constitutes a Level II?

- Per CPT billing codes, it is a Level I plus some components
  - Typically tailored to the indication
  - May include: orbits, lens, nasal bone, ears, maxilla, mandible, oropharynx, profile, scapulae, bilateral proximal and distal long bones, hands/fingers, feet/toes, longitudinal aortic arch, etc…
How good do we do?

• Level I
  – Specificity: 99%
  – Sensitivity:
    • RADIUS study, 1993: 35%
    • Helsinki US Trial, 1990: 52%
    • More current data: unknown

• Level II
  – Sensitivity: > 90%

• Caution answering: “Is everything OK?”

In Summary

• A Level I US is a lot more than looking at the fetus
• Adherence to such guidelines constitutes a “standard of care”
  – Increases sensitivity
  – May limit medicolegal exposure
• Recommend:
  – Be picky
  – Assume every pregnancy has an abnormality until proven otherwise


Thank you for your attention!