Ultrasound in Obstetrics

Who, Where, When and How Many?

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Clinical Considerations

• Should all patients be offered ultrasound?

• How many ultrasounds does a low risk patient need?

• What is the sensitivity for detecting fetal anomalies?

• What is the optimal gestational age for an obstetrical examination?

• What impact does maternal BMI play in antenatal ultrasound screening?
Should all patients be offered ultrasonography, and what is the sensitivity for detecting fetal anomalies?

- 90% of fetal anomalies are born to women considered “low risk”
- Sensitivity varies amongst studies
  - Different definition of major vs. minor malformation
  - Populations differences, high vs. low risk
  - Expertise of imaging
  - Structure imaged (DR higher with CNS vs. cardiac)
# Routine ultrasound screening for second trimester fetal malformations

<table>
<thead>
<tr>
<th>Reference</th>
<th>Place</th>
<th>Period</th>
<th>Fetuses (n)</th>
<th>Prevalence (%)</th>
<th>MF (n)</th>
<th>ΔMF (n)</th>
<th>Published sensitivity (%)</th>
<th>MF 2%</th>
<th>Standardized sensitivity (%)</th>
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<td><strong>Totals</strong></td>
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<td><strong>925 675</strong></td>
<td><strong>18 443</strong></td>
<td><strong>7460</strong></td>
<td><strong>40.4</strong></td>
<td><strong>18 514</strong></td>
<td><strong>40.3</strong></td>
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**Radius vs. Eurofetus ~ Trained Sonographers**
# Trends in Prenatal Ultrasound Use in the USA (1995-2006)

<table>
<thead>
<tr>
<th>Year</th>
<th>Average #Scans Per pregnancy (95% CI)</th>
<th>Low Risk</th>
<th>High Risk</th>
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<td>1995-1997</td>
<td>1.48 (1.26-1.70)</td>
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<td>1998-2000</td>
<td>1.59 (1.29-1.88)</td>
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<td>2005-2006</td>
<td>2.69 (1.91-3.47)</td>
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</table>

OR 2.02 (1.36, 3.00) P < 0.001

OR 1.19; (1.41, 2.59, P < 0.001

Siddique J et al Medical Care. 2009;47:1129-1135
AIUM Practice Guideline for the Performance of Obstetric Ultrasound Examinations

ACOG PRACTICE BULLETIN

CLINICAL MANAGEMENT GUIDELINES FOR OBSTETRICIAN–GYNECOLOGISTS

NUMBER 101, FEBRUARY 2009

REAFFIRMED 2011

Ultrasonography in Pregnancy

The American Institute of Ultrasound in Medicine (AIUM) is a multidisciplinary association dedicated to advancing the safe and effective use of ultrasound in medicine through professional and public education, research, development of guidelines, and accreditation. To promote this mission, the AIUM is pleased to publish, in conjunction with the American College of Radiology (ACR) and the American College of Obstetricians and Gynecologists (ACOG), this AIUM Practice Guideline for the Performance of Obstetric Ultrasound Examinations. We are indebted to the many volunteers who contributed their time, knowledge, and energy to bringing this document to completion.
Practice Guidelines

• Performance and recording of high-quality ultrasound examinations

• Minimum criteria for complete examination

• Not intended to establish a legal standard of care (SOC)

• Deviation from or exceeding guidelines will be needed in some cases

ACR—ACOG-AIUM Reston (VA), 2007;1025-1033
ACOG Practice Bulletin 101, 2009,
AIUM J Ultrasound Med 2010;29:157-166,
ISUOG Ultrasound Obstet Gynecol 2011;37 116-126
## Types of Examinations

<table>
<thead>
<tr>
<th>Study</th>
<th>CPT</th>
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<tr>
<td>Standard or basic</td>
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<tr>
<td>First Trimester</td>
<td>76801</td>
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<tr>
<td>Second Trimester</td>
<td>76805</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>76811</td>
</tr>
<tr>
<td>Limited</td>
<td>76815</td>
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<td>Specialized</td>
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<tr>
<td>First Screen</td>
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<tr>
<td>Doppler</td>
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<tr>
<td>- Umbilical artery</td>
<td>76820</td>
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<tr>
<td>- Middle cerebral artery</td>
<td>76821</td>
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<tr>
<td>Fetal Echo</td>
<td>76825</td>
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</table>

*Standard of care is by code not location*
Indications: 1st trimester

- Gestational dating
- Dx / evaluate multifetal
- Confirm IUP
- Aneuploidy screening
- Evaluate ectopic
- Vaginal bleeding
- Assess pelvic pain
- Confirm cardiac activity
- Adjust embryo transfer
- CVS guidance
- Removal IUD
- Evaluate maternal pelvic, uterine or adnexal pathology
- Suspected hydatidiform mole
Standard Examination Essential Elements 1st trimester Scan

- Gestational sac
  - Location
  - Yolk sac / embryo
  - Anembryonic ~ MGSD
- Crown rump length (CRL)
- Cardiac activity
  - TV ~ ≥ 5 mm embryo
  - < 5 mm w/o FHR repeat
- Fetal number
- Embryonic/fetal anatomy
  “Appropriate for 1st trimester assessment”?
- Multi-fetal
  - Chorionicity
  - Amnionicity
- Uterus, adnexa & cul-de-sac
- Aneuploidy screening
  - Nuchal translucency
    - NTQR
  - Fetal Medicine Foundation
- Additional observation
  - Nasal bone
  - Ductus venosus
  - Tricuspid regurgitation

Not SOC
Gestational Sac

Mean sac diameter
- Three orthogonal planes
- Inner diameter, excluding the echogenic rim
- Sum + divide by 3
- MSD = (30 + 12 + 18)/3 = 20

Rossavik et al. Fertil Steril 1988
N Hamill & RO Bahado-Singh, AIUM 2010
Gestational Sac

Linear growth early in pregnancy

Rule of thumb

- MSD (mm) + 30 = gestational age (GA; days)

Rossavik et al. Fertil Steril 1988
Dickey et al. Hum Reprod 1994
N Hamill & RO Bahado-Singh, AIUM 2010
Embryo

- Embryo seen

<table>
<thead>
<tr>
<th>Imaging</th>
<th>MSD</th>
<th>GA (days)</th>
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<tbody>
<tr>
<td>TV</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>TA</td>
<td>26</td>
<td>55</td>
</tr>
</tbody>
</table>

- C-shaped folding of embryo is not completed until 18-22 mm.

- Crown rump length then becomes appropriate terminology

Bree et al. AJR 1989; 153:75-79
Nyberg et al. Radiology 1986
N Hamill & RO Bahado-Singh, AIUM 2010
## Cardiac Motion

<table>
<thead>
<tr>
<th>Parameter</th>
<th>+ heart rate</th>
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<tbody>
<tr>
<td>Gestational age</td>
<td>37 days</td>
</tr>
<tr>
<td>MSD</td>
<td>18 mm</td>
</tr>
<tr>
<td>Embryo length (TV)</td>
<td>3-5 mm</td>
</tr>
</tbody>
</table>

N Hamill & RO Bahado-Singh, *AIUM* 2010
Guidelines for Nuchal Translucency

- Margins of NT edges must be clear enough for proper caliper placement
- Fetus in a midsagittal plane
- Imaged magnified so that head, neck & upper thorax fill image
- Neck in neutral position
- Amnions seen separate from NT
- Calipers (+) placed on inner borders of the nuchal space, perpendicular to the long axis of the fetus
- NT measured at the widest sac.
- Fetal CRL between 38-84mm
First trimester ~ Anatomic Survey

“Appropriate for 1st trimester assessment”

- Orbits
- Nasal bone
- Cerebellum
- Falx
- 4th ventricle
- CM/ICT
- Choroid Plexus
First Trimester Imaging
Fetal Heart

4 chambered heart
RVOT  LVOT  3 vessel
Aortic arch  Ductal Arch
First Trimester Imaging
Trunk & Extremities
First trimester ~ Anatomic Survey
Fetal Malformations

Acrania
Diaphragm Hernia
Megacystis
Holoprosencephaly
Polydactyly
Omphalocele

Sygelaki A et al Prenat Diagn 2011;31:90-102
# FIRST TRIMESTER*
Detection Rate of Fetal Abnormalities

<table>
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<th>System</th>
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<tr>
<td>Neck Anomalies</td>
<td>100%</td>
</tr>
<tr>
<td>Neural Tube Defects</td>
<td>100%</td>
</tr>
<tr>
<td>Heart anomalies</td>
<td>25%</td>
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<tr>
<td>Limb defects</td>
<td>50%</td>
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<tr>
<td>Overall</td>
<td>70%</td>
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</table>

*11-13 weeks

Ultrasound Detection of Major Fetal Malformations

<table>
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<tr>
<th>Author</th>
<th>N</th>
<th>Method</th>
<th>Major Anomaly</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Trimester</th>
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<td>Economides, 98</td>
<td>1,632</td>
<td>TA + TV</td>
<td>1%</td>
<td>65%</td>
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<tr>
<td>Guariglia, 00</td>
<td>3,478</td>
<td>TV</td>
<td>2%</td>
<td>52%</td>
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<tr>
<td>Carvalho, 02</td>
<td>2,853</td>
<td>TA + TV</td>
<td>2.3%</td>
<td>38%</td>
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<td>Taipale, 03</td>
<td>20,465</td>
<td>TV</td>
<td>1.5%</td>
<td>52%</td>
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<tr>
<td>Chen, 04</td>
<td>1,609</td>
<td>TA + TV</td>
<td>1.6%</td>
<td>54%</td>
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<td>Souka, 06</td>
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<td>50%</td>
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<td>Cedergren, 06</td>
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<td>40%</td>
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<td>Saltvedt, 05</td>
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<td>71%</td>
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<td>Dane, 07</td>
<td>1,290</td>
<td>TA + TV</td>
<td>11.9%</td>
<td>70%</td>
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</table>
Indications: 2\textsuperscript{nd}/3\textsuperscript{rd} trimester

- Gestational dating
- Fetal growth
- Vaginal bleeding
- Cervical insufficiency
- Abdominal/pelvic pain
- Fetal presentation
- Suspected multi-fetal
- PPROM or PTL
- Increase risk aneuploidy
- Fetal anomaly screening

- Adjust to procedures
- Size/dates discrepancy
- Evaluation pelvic mass
- Hydatidiform mole
- Ectopic pregnancy
- Uterine abnormality
- Fetal well-being
- Amniotic fluid abnormalities

- Placenta
  - Abruption
  - Location ~ Previa
  - Implantation ~ previous C-sec
Standard Examination Essential Elements

2\textsuperscript{nd\textdagger}*/3\textsuperscript{rd} trimester ultrasound

(76805)

• Fetal presentation
• Amniotic fluid volume
• Cardiac activity (FHR)
• Placental position
• Fetal biometry
• Fetal number
• Anatomic survey*
• Maternal cervix and adnexa

> 18 weeks
Amniotic Fluid Volume Assessment

• Qualitative assessment
  • Normal
  • Increased/hydrarnios
  • Decreased/oligohydrarnios

• Semi-quantitative assessment
  • Maximum vertical pocket
    • Multi-fetal
    • Oligohydrarnios ~ 2cm
    • Polyhydramnios ~ 8cm
  • Amniotic fluid index
    • Oligohydrarnios ~ 5cm
    • Polyhydramnios ~ 24 cm
  • Two-diameter pocket

Does not allow for longitudinal assessment AFV
## Placenta

Likelihood of previa or low lying placenta  
At delivery

<table>
<thead>
<tr>
<th>Ultrasound</th>
<th>15-19</th>
<th>20-23</th>
<th>24-27</th>
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<tr>
<td>1-5mm</td>
<td>6%</td>
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<td>12%</td>
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<tr>
<td>no prior C-sec</td>
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<tr>
<td>1-5 mm</td>
<td>7%</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>prior C-sec</td>
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<td></td>
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</tr>
<tr>
<td>Previa</td>
<td>20%</td>
<td>45%</td>
<td>56%</td>
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<tr>
<td>no prior C-Sec</td>
<td></td>
<td></td>
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<tr>
<td>Previa</td>
<td>41%</td>
<td>73%</td>
<td>84%</td>
</tr>
<tr>
<td>prior C-sec</td>
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</tr>
<tr>
<td>Degree of overlap</td>
<td></td>
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<tr>
<td>≥ 20 mm</td>
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<td>90-100%</td>
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<tr>
<td>≥ 25 mm</td>
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<td>90-100%</td>
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</table>

Modern Medicine 2010
Fetal Biometry

• Biparietal diameter
  Axial view level of thalami
  900 to midline echoes
  Hemispheres symmetrical
  Cerebellum not seen
  Caliper “outer to inner”

• Head circumference
  outside of skull bone echoes
  manual trace/ellipse
  \[ HC = 1.62 \times (BPD + OFD) \]
Fetal Biometry

Abdominal Circumference
• Transverse section of fetal abdomen
• Umbilical vein at level of portal sinus
• Stomach bubble visualized
• Kidneys not visible
**Fetal Biometry**

**Femur length**

- After 14 weeks
- Both ends ossified metaphysis clearly visible
- Long axis shaft measured with beam of insonation perpendicular to shaft.
- Exclude epiphysis in measurement
# Assessment of Gestational Age

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Gestational age, wks</th>
<th>Accuracy, days</th>
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<tbody>
<tr>
<td>Mean sac diameter</td>
<td>4.5 - 6</td>
<td>+/- 5-7</td>
</tr>
<tr>
<td>Crown rump length</td>
<td>7 – 10</td>
<td>+/- 3</td>
</tr>
<tr>
<td></td>
<td>10 – 14</td>
<td>+/- 5</td>
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<tr>
<td></td>
<td>15</td>
<td>+/- 8.4</td>
</tr>
<tr>
<td>BPD, HC, FL</td>
<td>14 – 20</td>
<td>+/- 7</td>
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<tr>
<td></td>
<td>21 – 30</td>
<td>+/-14</td>
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<tr>
<td></td>
<td>&gt; 30</td>
<td>+/- 21- 28</td>
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</tbody>
</table>

BPD: biparietal diameter  
HC: head circumference  
FL: femur length
Estimates of Fetal Weight

- Hadlock
  - BPD, HC, AC, FL
  - AC, FL
  - BPD, AC, FL
  - HC, AC, FL
  - BPD, AC
- Warsof: BPD, AC
- Shephard: BPD, AC
- Merz: BPD, AC
- Marsal: BPD, ATD, AAP, FL

Patient population
Anatomic parameters
Maternal BMI
Fetal position
Gestational age

+/- 15%
# Ultrasound for Fetal assessment

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to detect twins &lt; 24 wks</td>
<td>0.07</td>
<td>0.03-0.17</td>
</tr>
<tr>
<td>Induction of labor for postdates</td>
<td>0.59</td>
<td>0.42-0.83</td>
</tr>
</tbody>
</table>

*Whitworth M et al, Cochrane Database Syst Rev 2010*
Standard Examination Essential Elements
2\(^{nd}/3^{rd}\) trimester fetal anatomic survey
(76805)

- **Head, face and Neck**
  - Cerebellum / Cisterna magna
  - Choroid plexus
  - Lateral ventricles
  - Midline falx
  - Cavum septi pellucidi
  - Upper lip (nostrils)

- **Chest-heart**
  - 4-chambered heart
  - Outflow tracts (attempt)

- **Abdomen**
  - Stomach
  - Kidneys
  - Umbilical cord insertion
  - Bladder & Umbilical cord vessels

- **Spine**

- **Extremities**
  - Legs
  - Arms

- **Sex/Gender**
  - Medically indicated only in low-risk pregnancies for multiples

**Suboptimal imaging should be documented with plan to resolve**
Basic Fetal Anatomic Survey

Head
Basic Fetal Anatomic Survey
Head
Basic Fetal Anatomic Survey

Face
Basic Fetal Anatomic Survey

Face
Basic Fetal Anatomic Survey

Face
Basic Fetal Anatomic Survey

Face

Midfacial hypoplasia
Basic Fetal Anatomic Survey
Heart

• General
  – Normal situs, axis and position
  – Heart occupies 1/3 of chest
  – Majority in the left chest
  – Four chambers present
  – Views of the outflow tracts if technically feasible
  – No pericardial effusion
Fetal Anatomic Survey
Heart

Extended Basic Exam: LOVT & RVOT

Increase detection conotruncal anomalies
Tetralogy of Fallot,
Transposition of great arteries,
Double outlet Rt vent
Truncus Aterious
Basic Fetal Anatomic Survey
Abdomen

- Stomach present size & situs
- Kidneys/renal pelves
- Bladder & umbilical cord vessels
- Anterior abdominal wall w/ cord insertion
Basic Fetal Anatomic Survey
Spine

• Satisfactory assessment
  – Fetal position dependent
  – Expertise & meticulous scanning
  – Complete evaluation from every projection not part of basic exam

• Transverse & sagittal views usually informative

• Most serve forms of spinal abnormalities have secondary intracranial findings
  – Spina bifida with cerebella herniation
Basic Fetal Anatomic Survey
Limbs & Extermitities

ACOG: Does not include hands/feet
ISUOG includes hands/feet w/o counting digits
### 2nd Trimester detection rate & incidence of the more common fetal abnormalities

<table>
<thead>
<tr>
<th>System</th>
<th>DR*</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Nervous System</td>
<td>76%</td>
<td>1:1,600</td>
</tr>
<tr>
<td>Renal</td>
<td>67%</td>
<td>1-5%</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>50%</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>42%</td>
<td>1:2,500 (omphalocele)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1:4,300 (gastroischisis)</td>
</tr>
<tr>
<td>Skeletal</td>
<td>24%</td>
<td>1:500</td>
</tr>
<tr>
<td>Cardiac</td>
<td>17-40%</td>
<td>1:125</td>
</tr>
<tr>
<td>AVSD</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>VSD</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>HLHS</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Outflow tract anomalies</td>
<td>21%</td>
<td></td>
</tr>
</tbody>
</table>

* Low risk population

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Earliest gestational age at which diagnosis of selective anomalies can be reasonably made

<table>
<thead>
<tr>
<th>System</th>
<th>11-14 wks</th>
<th>18-22 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anencephaly</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Holoprosencephaly</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>ACC</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Microcephaly</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Hydrocephalus</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Spina bifida</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDH</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CCAM</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>GI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastroschisis</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Omphalocele</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System</th>
<th>11-14 wks</th>
<th>18-22 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Hydronephrosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilateral Renal Agenesis</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Severe MCDKD/PCKD</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Megacystis</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Neck/Face</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Cleft lip/palate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cystic hygroma</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Skeletal</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Arthrogryprosis</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Osteogenesis Imperfecta</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Achondroplasia</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Extremities</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Talipes equinovarus</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

## Ultrasound Detection of Major Fetal Malformations Combined 1\textsuperscript{st} & 2\textsuperscript{nd} trimester

<table>
<thead>
<tr>
<th>Author</th>
<th>N</th>
<th>Method</th>
<th>Major Anomaly</th>
<th>1\textsuperscript{st} Trimester</th>
<th>Total Detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economides, 98</td>
<td>1,632</td>
<td>TA +TV</td>
<td>1%</td>
<td>65%</td>
<td>82%</td>
</tr>
<tr>
<td>Guariglia, 00</td>
<td>3,478</td>
<td>TV</td>
<td>2%</td>
<td>52%</td>
<td>84%</td>
</tr>
<tr>
<td>Carvalho, 02</td>
<td>2,853</td>
<td>TA +TV</td>
<td>2.3%</td>
<td>38%</td>
<td>79%</td>
</tr>
<tr>
<td>Chen, 04</td>
<td>1,609</td>
<td>TA +TV</td>
<td>1.6%</td>
<td>54%</td>
<td>77%</td>
</tr>
<tr>
<td>Souka, 06</td>
<td>1,148</td>
<td>TA +TV</td>
<td>1.2%</td>
<td>50%</td>
<td>92%</td>
</tr>
<tr>
<td>Dane, 07</td>
<td>1,290</td>
<td>TA +TV</td>
<td>11.9%</td>
<td>70%</td>
<td>95%</td>
</tr>
</tbody>
</table>
Percentage of Anomaly Scans Completed by Gestational Age

<table>
<thead>
<tr>
<th>Gestational weeks</th>
<th>18-19</th>
<th>20-21</th>
<th>22-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>% scans completed</td>
<td>76%</td>
<td>90%</td>
<td>89%</td>
</tr>
<tr>
<td>(number)</td>
<td>(306)</td>
<td>(371)</td>
<td>(393)</td>
</tr>
</tbody>
</table>

Calls into question the AIUM/ACOG Recommendation For routine screening at 18 - 22 weeks

Schwarzler P et al Ultrasound Obstet Gynecol 199;14:92-7
Obesity Trends* Among U.S. Adults
BRFSS, 2010

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)
Maternal obesity is associated with an increased risk of structural anomalies. Absolute risk is likely to be small however, detection rate is inversely related to BMI.

<table>
<thead>
<tr>
<th>Anomaly</th>
<th>Odds Ratio 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spina Bifida</td>
<td>2.24 (1.86-2.69)</td>
</tr>
<tr>
<td>Cardiac</td>
<td>1.30 (1.12-1.51)</td>
</tr>
<tr>
<td>Cleft palate</td>
<td>1.23 (1.03-1.47)</td>
</tr>
<tr>
<td>Anorectal atresia</td>
<td>1.48 (1.12-1.97)</td>
</tr>
<tr>
<td>Hydrocephaly</td>
<td>1.68 (1.19-2.36)</td>
</tr>
<tr>
<td>Limb reduction</td>
<td>1.34 (1.03-1.73)</td>
</tr>
<tr>
<td>Gastrochisis</td>
<td>0.17 (0.10-0.30)</td>
</tr>
</tbody>
</table>

Stothard KJ et al [JAMA. 2009;301:636-50]
Maternal Obesity Limits Ultrasound Evaluation of Fetal Anatomy

<table>
<thead>
<tr>
<th></th>
<th>BMI: 35.7 (range:30-65)</th>
<th>Controls BMI: 20-25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete</td>
<td>26%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Visibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>satisfactory</td>
<td>28%</td>
<td>89%</td>
</tr>
<tr>
<td>moderate</td>
<td>46%</td>
<td>8%</td>
</tr>
<tr>
<td>unsatisfactory</td>
<td>26%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Effects of Maternal Obesity on Ultrasound Detection of Anomalous Fetuses

Dashe JS et al Obstet Gynecol;2009;113:1001-7
Comprehensive/Level II/Targeted/Genetic Ultrasound

76811

- Not intended as a routine scan performed for all pregnancies
- Indicated for suspected or increased risk of fetal or genetic abnormalities
- Expected to be rarely performed outside of referral practices
- Only one medically indicated 76811 per pregnancy per practice
- Includes all of the components of 76805 with detailed fetal anatomic survey
## Components of Comprehensive Ultrasound 76811

### Intracranial/Face/Spine
- Lateral*, 3\textsuperscript{rd} & 4\textsuperscript{th} ventricles
- Cerebellum*, integrity of lobes* and vermis*
- Cavum septum pellucidum
- Cisterna magna*
- Nuchal fold* (15-20 wks)
- Integrity of cranial vault
- Brain parenchyma
- Ear position and size
- Upper lip integrity*
- Palate*
- Profile*
- Neck ~ masses

### Chest
- Presence of masses*
- Pleural effusion*
- Integrity of diaphragm*
- Appearance of ribs

### Heart
- Cardiac location, axis and outflow tracts*

### Abdomen
- Bowel*
- Adrenal gland
- Liver
- Spleen
- Ascites* and masses

*Integral components
Fetal Anatomic Survey

Heart

• General
  – Normal situs, axis and position
  – Heart occupies 1/3 of chest
  – Majority in the left chest
  – Four chambers present
  – Views of the outflow tracts if technically feasible
  – No pericardial effusion
• Atria
  – Equal in size
  – Foramen ovale flap in Lt atrium
  – Atrial septum primum present

• Ventricles
  – Equal in size
  – No cardiac wall hypertrophy
  – Moderator band at Rt ventricular apex
  – Ventricular septum intact

• AV Valves
  – Valves open freely
  – Tricuspid valves inserts closer to the apex

ISUOG Practice Guidelines Cardiac Scan Ultrasound Obstet Gynecol 2006
Components of Comprehensive Ultrasound 76811

Genitalia
• Gender (whether or not parents wish to know)

Limbs
• Number, size and architecture*
• Anatomy and position of hands and feet*

Placenta and Cord
• Placental cord insertion site
• Placental masses
• Umbilical cord

Amniotic fluid volume*
Evaluation of cervix & maternal adenxa when feasible

• Pre-service work
  Review clinical information and histories; prior images or reports

• Intra-service work
  Performance or supervision and interpretation of exam; assess proper components will vary

• Post-service work
  Prepare comprehensive report; discuss findings with patient & referring; review and sign report

*integral components
Effectiveness of Prenatal Ultrasound

• Prenatal ultrasound may reduce perinatal mortality,
  – primarily through elective abortions for congenital anomalies,
  – does not appear to lower live birth rates.
• Has no proven effect on neonatal morbidity,
• Provides more accurate estimates of gestational age that prevent unnecessary inductions for post-term pregnancy.
• Screening detects
  – multiple gestations,
  – congenital anomalies, and
  – intrauterine growth retardation,
• Ultrasound has both positive and negative psychological effects on parents.

Woolf SH Int J Technol Assess Health Care 2001
Conclusions

• Should all patients be offered ultrasound? Yes

• How many ultrasounds does a low risk patient need? 2

• What is the sensitivity for detecting fetal anomalies? > 70%

• What is the optimal gestational age for an obstetrical examination? 1st Tri 12-14 wks, 2nd Tri 18-22 wks

• What impact does maternal BMI play in antenatal ultrasound screening? Efficacy of screening inversely related BMI
Thank you for your attention