“Basic fetal ultrasound exam”

Françoise Rypens, MD, FRCP

Orlando 2013

Department of Medical Imaging
Ste-Justine Mother-Child University Hospital Center
University of Montreal, Quebec, Canada
What is a fetal basic ultrasound?

- Accurate diagnostic information
  - gestational age, growth
  - anatomy (anomaly detection)
  - number of fetuses

- Guidelines (ACR, ACOG, AIUM, ISUOG, CAR*, SOGC*..)
  - $1^{st}$ T / $2^{nd}$ T / $3^{rd}$ T
  - = minimal requirements

(Canada*)
Guidelines: 1st Trimester

- Location of pregnancy (gestational sac, yolk sac, embryo)
- Gestational age: CRL (mean gestational sac diameter), bpd
- Cardiac activity (> 5 mm)
- Number: chorionicity, amnionicity
- « appropriate anatomy » (nuchal region)
- Uterus (cervix), adnexae, cul-de-sac
Basic 2nd T fetal US: who / when?

- For all pregnancies
- 18 – 22 wga (compromise datation / anatomy / management) (13 – 16 wga)
- Well trained professionals
- Up to date equipment
- ALARA (time and power exposure)
Basic 2\textsuperscript{nd} T fetal US: how?

6 steps:

• 1. Viability, location
• 2. Number
• 3. Biometry
• 4. Basic anatomy
• 5. Environment
• 6. Information transmission (report / documentation)
1: fetal viability

- **Heart beating**
  
  N: 120 – 160 bpm
  
  physiological variations
  
  ! Bradycardy < 110 bpm
  
  ! Persistent tachycardy > 160 bpm

- **Fetal motion**
  
  body, extremities
1: fetal location

19 wga, routine US
1: fetal location

- Verify!

19 wga, routine US
2: twinning

- 1\textsuperscript{st} T the best timing
- Mandatory: chorionicity / amnionicity

<table>
<thead>
<tr>
<th></th>
<th>Dichorionic</th>
<th>Monochorionic Diamniotic</th>
<th>Monochorionic monoamniotic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placenta</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Membrane</td>
<td>thick</td>
<td>thin</td>
<td>$\varnothing$</td>
</tr>
<tr>
<td>$\Delta$, twin peak</td>
<td>$\lambda$</td>
<td></td>
<td>$\varnothing$</td>
</tr>
<tr>
<td>Gender</td>
<td>$=$ / $\neq$</td>
<td>$=$</td>
<td>$=$</td>
</tr>
<tr>
<td>entangled cords</td>
<td>$\varnothing$</td>
<td>$\varnothing$</td>
<td>$+$</td>
</tr>
</tbody>
</table>
3: biometry: requisites

- Purpose: \( \{ \) gestational age
  \( \) growth
  \( \) aneuploidy, malformation? \( \}

- Biparietal diameter
- Fronto-occipital diameter / head circumference
- Mean abdominal diameter / abdominal circumference
- Femoral diaphysis length
3: biometry: general principles

- Rigorous technique
- Repeated measurements
- Same technical requirements than the charts used
- Charts adapted to the population
- Report: percentiles (gest age). Z score, mean for gest age, curves,.....
Biparietal diameter (bpd)

- Axial view (thalami) perpendicular insonation to the falx
  symmetrical appearance of hemispheres
- Measurements perpendicular / midline leading edge technique (outer / inner)
  (> outer / outer)
- Gest age +/- 7 days (12 – 19 wga)
Head circumference (HC)

- Axial, symmetrical parallel to the skull base
  - midline falx – cavum SP – thalami – ambiant cistern
  - cerebellum
- outer – outer
- HC = 1.57 (bpd + fod)
- Gest age +/- 4.2 days (16 – 19 wga)
Abdominal circumference (AC) / mean abdominal diameter

- Axial scan: round!
  (< 5 mm diam discrepancy)
symmetrical ribs
stomach
umbilical vein – portal sinus
confluence
adrenal (no kidney)
- Outer surface of the skin
Femoral diaphysis length

- **Technique:**
  - most proximal femur
  - insonation angle < 60 degree
  - cartilaginous ends
  - longest axis of diaphysis

- **NB:** distal spur artifact
  - both femurs
  - (1 – 2 mm discrepancy N)
4: basic fetal anatomy

• Be SYSTEMATICAL
  = the only way not to miss something major

• Standard scans ...and a little bit more
Fetal head

- **REQUISITES:**
- Skull: integrity, shape, size, bone density
- Hemispheres: ventricles, atria, choroid plexus
- Midline: falx, cavum
- Posterior fossa: cerebellum, cisterna magna

Fetal head: skull

- Size (bpd, fod, hc)
- Shape: N oval & regular
- Integrity
- Density
Fetal head: hemispheres

- 2 hemispheres
- MIDLINE:
  - falx
  - cavum SP (16 – 37 wga)
  - (Corpus callosum)

Cavum SP

Fornix
Fetal heads: ventricles

- Axial scan
- Landmarks:
  - cavum SP / fornix / ambiant cistern
  - choroid plexus glomus / int Pa-Oc sulcus perpendicular to V axis
  - int / int
- $N < 10$ mm
• 2 ventricles!
Choroid plexus

- Homogeneous
- In frontal / occipital horns
- Fill the atrium
- Wall – plexus < 3 mm
Posterior fossa

- Cerebellum:
  - 2 hemispheres
  - 1 vermis

- Transversal diam (ext / ext) ~ nb wga < 23 wga

- Cisterna magna
  - 2 – 10 mm
  - thin septa
GUIDELINES:
2 orbits
mouth
upper lip
nose / nostrils*

NB: orbits: rule of 3
center / center ~ wga

(* CAR)
Median facial profile!

- ☐ in guidelines
- Very useful:
  - skull
  - brain
  - face
  - clefts
  ...

N
Neck

- **GUIDELINES:**
  - ○ mass
  - nuchal fold (16 – 20 wga)*
  - Axial: thalami / cerebellum
  - Skin to bone (ext / ext)

- Ste Justine:
  - 14 – 17 wga: < 5 mm
  - 17 – 21 wga: < 6 mm
  - (LHR T 21 = 17)

(* CAR)
Spine

- GUIDELINES:
  - ⚖️ defect, ⚖️ mass
  - axial, sagittal views
- Min 2 planes
- Skin
- Ossification centers (regular, ⚖️ scoliosis)
- Head to rump
Chest: guidelines

- Size, appearance, shape
- Heart:
  - activity
  - axis, size, position
  - 4 chamber view
  - outflow tracts *
- Lungs
- \( \subset \) mass
- (diaphragmatic interface)

(* if possible, CAR)
Heart

- N situs
- < 1/3 chest area
- 45 +/- 20 ° towards the left
- Majority in left chest
- 120 – 160 bpm
- No pericardial fluid ( < 2 mm)

Heart: 4 chamber view

- Atria: L = R
  foramen ovale (flap to left)
  septum I (crux)
- Ventricles: L = R
  septum
  moderator band (R)
- Valves: 2!
- NOT ENOUGH!
Abdomen

- **GUIDELINES:**
  - Stomach (presence, position)
  - N Bowel ( < 2 mm, < bone, \( \cap \) fluid)
  - cord insertion (number* of vessels)
  - genitalia* (if medically indicated)
Abdomen: urinary tract

- GUIDELINES:
  2 Kidneys (≠ Adrenals)
  length = wga
  cortico-medullary differentiation > 18 wga
  ap pelvis diam < 4 mm (2nd T)
  bladder*
GUIDELINES:
« 4 limbs to the level of hands & feet »

- not enough
- 2 sides
- proximal to distal
- 3 segments
- motion
5: Fetal environment

- GUIDELINES:
  Amniotic fluid (qualitative / semi quantitative)
  Placenta (appearance, position / IO)
  Pertinent maternal anatomy
    uterus (mass, malformation)
    cervix
    adnexae
Final step: Transmission of information

• Report:
  clear, precise, easy to read
date of exam
gestational age, growth
limits of the exam (what & why)
anomalies
recommendations (follow-up, 3rd level…)

• Inform the patient!
Documentation & archives

- Local legislation
- Minimum: the requisites of scientific societies!
Please, go beyond the guidelines of scientific societies
Suggested lectures

• ACR, AGOC, AIUM practice guidelines for performance of obstetrical ultrasound
• ISUOG, CAR, SOGC guidelines
• J US Med 2010, 29: 157-166
• JOGC 2009, 31 (3): 272-275
• JOGC 2011, 38 (6): 643-656