DISCLOSURES

1. No financial disclosures
2. I do research in FGR
OBJECTIVES

Review...

1. screening
2. definitions & diagnostic criteria
3. when / how to start a workup
4. management
HISTORY

- Sept 1944 – May 1945
- 1800 → 500 kcal/day
DUTCH HUNGER WINTER

- Lifelong sequelae:
  - Glucose intolerance, coronary heart disease, kidney disease
  - Cognitive aging
  - All-cause mortality

- DO HaD: Developmental Origins of Health and Disease

Lifelong sequelae:
- Glucose intolerance, coronary heart disease, kidney disease
- Cognitive aging
- All-cause mortality

Adulthood
- Heart disease
- Stroke
- Death

Prenatal
- Preeclampsia
- Fetal growth restriction
- Stillbirth

Postnatal
- NICU
- Seizures
- Cerebral palsy
- Death

References:
- Roseboom et al. Early Hum Dev. 2006
- de Rooij et al, Proc Natl Acad Sci 2010
- Ekamper and Lumey, Social Science & Medicine, 2014
- Crispi et al, Circulation 2010
- Levine et al, Pediatrics 2015
- Crispi et al, AJOG 2018
- Ananth et al, AJOG 2006
- Jarvis et al, Lancet. 2003
- McIntire et al, NEJM 1999
OBJECTIVES

Review...
1. screening
2. definitions & diagnostic criteria
3. when / how to start a workup
4. management
SC REENING

Who needs ultrasound?
- Not everyone!
- can’t do/interpret fundal height
- FH off by +/- 3 cm
- Risk factors!

OBJECTIVES

Review...

1. screening
2. definitions & diagnostic criteria
3. when / how to start a workup
4. management
DEFINING CONCEPTS

• Small for gestational age (SGA): size $< 10^{th}$ percentile.
  – Maybe normal, maybe not

• Fetal growth restriction (FGR): Inability to achieve growth potential
  – Not normal
FGR IN PRACTICAL TERMS

• ACOG: EFW <10th percentile
• RCOG: EFW or AC <10th percentile
• SOGC: EFW or AC <10th percentile
• ISUOG:
  – EFW/AC <3rd or
  – EFW <10th and evidence of compromise

ACOG Practice Bulletin no. 204
RCOG Green top guideline No. 31
SOGC Clinical Practice guideline No. 295
ISUOG Practice Guideline: ultrasound assessment of fetal biometry and growth. 2019
# DEFINING FGR – IT'S COMPLICATED

<table>
<thead>
<tr>
<th>N</th>
<th>Design</th>
<th>Derived using...</th>
<th>Maternal population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brenner – 1976</td>
<td>30,772 Retrospective</td>
<td>BW, PG abortions</td>
<td>Cleveland, OH: white, black</td>
</tr>
<tr>
<td>Williams – 1982</td>
<td>2,265,478 Retrospective</td>
<td>BWs</td>
<td>CA; mixed; included stillbirths</td>
</tr>
<tr>
<td>Hadlock – 1991</td>
<td>392 Prospective</td>
<td>EFWs</td>
<td>Houston, TX; white, middle-class</td>
</tr>
<tr>
<td>NICHD – 2015</td>
<td>2335 Prospective</td>
<td>EFWs- <em>normals</em></td>
<td>U.S. – 12 centers</td>
</tr>
</tbody>
</table>
Salomon
N=18,959

DEFINING FGR – ITS COMPLICATED

• US report:
  – EFW: 25th percentile (Brenner)
    • BPD: 5th
    • HC: 5th
    • AC: 5th
    • FL: 5th

@nateyblue

Hadlock
OBSTETRICS

Comparing the Hadlock fetal growth standard to the Eunice Kennedy Shriver National Institute of Child Health and Human Development racial/ethnic standard for the prediction of neonatal morbidity and small for gestational age

Nathan R. Blue, MD; Meghan E. Beddow, MD; Mariam Savabi, MD, MPH; Vivek R. Katukuri, MD; Conrad R. Chao, MD

- Hadlock vs NICHD, N=1,514
- EFW within 30d of delivery
- Outcomes:
  - Prediction of neonatal morbidity and SGA
  - Rates of FGR using each standard
  - Birthweight percentile prediction
**Table 4. Neonatal Outcomes by Fetal Growth Status**

<table>
<thead>
<tr>
<th>Neonatal Outcome</th>
<th>EFW Greater Than 10th Percentile (n=1,415)</th>
<th>FGR by ACOG (n=232)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTB</td>
<td>304 (21.5)</td>
<td>72 (31.0)</td>
</tr>
<tr>
<td>GA at delivery (wk)</td>
<td>37.9±2.7</td>
<td>36.7±3.2</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>3,076±686</td>
<td>2,315±1,436</td>
</tr>
<tr>
<td>NICU admission</td>
<td>271 (19.2)</td>
<td>66 (28.4)</td>
</tr>
<tr>
<td>NICU stay greater than 48 h</td>
<td>262 (18.5)</td>
<td>65 (28)</td>
</tr>
<tr>
<td>RDS</td>
<td>79 (5.6)</td>
<td>22 (9.5)</td>
</tr>
<tr>
<td>NEC</td>
<td>20 (1.4)</td>
<td>2 (0.9)</td>
</tr>
<tr>
<td>Mechanical ventilation greater than 24 h</td>
<td>32 (2.3)</td>
<td>15 (6.5)</td>
</tr>
<tr>
<td>Supplemental O₂</td>
<td>164 (11.6)</td>
<td>47 (20.3)</td>
</tr>
<tr>
<td>Bag–mask ventilation</td>
<td>70 (4.9)</td>
<td>22 (9.5)</td>
</tr>
<tr>
<td>Intubation</td>
<td>30 (2.1)</td>
<td>14 (6.0)</td>
</tr>
<tr>
<td>Chest compressions</td>
<td>5 (0.4)</td>
<td>2 (0.9)</td>
</tr>
<tr>
<td>Death before discharge</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>
DEFINING FGR – ITS COMPLICATED

Fetus is small – 3 possibilities:

- Constitutionally small
- FGR in evolution – no compromise
- FGR with compromise
OBJECTIVES

Review...

1. screening
2. definitions & diagnostic criteria
3. when / how to start the workup
4. management
DEFINING FGR

How can I tell?

• Isolated EFW or AC <10th → check again

• Other findings → MFM
  – Severe (EFW/AC <3rd)
  – Early (<24 weeks)
  – Dopplers
  – Ultrasound findings: anomaly, infection, aneuploidy
ETIOLOGIES

- Maternal conditions
- Placental insufficiency
- Fetal
- Trans-placental infection (TORCHES)

Box 1. Etiology of Fetal Growth Restriction

- Maternal medical conditions
  - Pregestational diabetes mellitus
  - Renal insufficiency
  - Autoimmune disease (e.g., systemic lupus erythematosus)
  - Cyanotic cardiac disease
  - Pregnancy-related hypertensive diseases of pregnancy (e.g., chronic hypertension, gestational hypertension, or preeclampsia)
  - Antiphospholipid antibody syndrome
- Substance use and abuse (e.g., tobacco, alcohol, cocaine, or narcotics)
- Multiple gestation
- Teratogen exposure (e.g., cyclophosphamide, valproic acid, or antithrombotic drugs)
- Infectious diseases (e.g., malaria, cytomegalovirus, rubella, toxoplasmosis, or syphilis)
- Genetic and structural disorders (e.g., trisomy 13, trisomy 18, congenital heart disease, or gastroschisis)
- Placental disorders and umbilical cord abnormalities
THE WORKUP

• Maternal conditions
• Placental insufficiency
• Infection
• Fetal
  – anomalies
  – syndrome

H&P
Dopplers
Growth trajectory surveillance
TORCHES
Ultrasound (anatomy)
Genetic testing
DEFINING FGR

EFW/AC <10^{th}

Red flag?

yes

Workup!

no

Repeat US in 3-4w

Not reassuring

Stable

Constitutionally small

MFM

Red flags:
- EFW/AC <3%
- Early onset
- Abnormal US
- Abnormal Dopplers
OBJECTIVES

Review...

1. screening
2. definitions & diagnostic criteria
3. when / how to start a workup
4. management
Suspected IUGR

Weekly UA Doppler

Normal UA Doppler
- Consider delivery at 38-39 weeks

Abnormal UA Doppler
- Decreased diastolic flow
  - Increase frequency of testing
  - Consider delivery at >37 weeks
- Absent end diastolic flow
  - Corticosteroids
  - Consider delivery at >34 weeks
- Reversed end diastolic flow
  - Corticosteroids
  - Consider delivery at >32 weeks

Start NST/BPP 2x/wk at "viability"
Infant wellbeing at 2 years of age in the Growth Restriction Intervention Trial (GRIT): multicentred randomised controlled trial

The GRIT study group

<table>
<thead>
<tr>
<th></th>
<th>All gestations</th>
<th>24–30 weeks</th>
<th>31–36 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Immediate (n=290)</td>
<td>Deferred (n=283)</td>
<td>Immediate (n=107)</td>
</tr>
<tr>
<td>Number of deaths (%)</td>
<td>34 (12%)</td>
<td>32 (11%)</td>
<td>25 (23%)</td>
</tr>
<tr>
<td>Number with disability (%)</td>
<td>21 (7%)</td>
<td>12 (4%)</td>
<td>14 (13%)</td>
</tr>
<tr>
<td>None of the above (%)</td>
<td>235 (81%)</td>
<td>239 (84%)</td>
<td>68 (64%)</td>
</tr>
<tr>
<td>Griffiths DQ score for survivors (median [IQR])</td>
<td>100 (90–111)</td>
<td>100 (92–110)</td>
<td>97 (82–108)</td>
</tr>
</tbody>
</table>

Table 3: Main fetal outcomes at 2 years of age

(OR 1.1, 95% CrI 0.7–1.8)
Induction versus expectant monitoring for intrauterine growth restriction at term: randomised equivalence trial (DIGITAT)

Immediate group: 17 (5.3%)
Delayed group: 20 (6.1%)
Diff -0.8% (-4.3% to 2.8%)
OBJECTIVES

We reviewed:
1. screening  **Indication driven!**
2. definitions & diagnostic criteria  EFW or AC <10th
3. When /how to work it up  **When: Red flags!**  **How: TORCHES**
4. management
THE END

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