Gestational Diabetes: An Update on Testing

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Gestational Diabetes

- Increased risks of:
  - Still Birth
  - Hydramnios
  - Should Dystocia
  - Prolonged Labor
  - Preeclampsia
  - Macrosomia
  - Habitual Abortions

Smith, S, Schragg, W. Gestational Diabetes. Obstetrics and Gynecology. 31(2):228-239
Gestational Diabetes :

“Carbohydrate intolerance that begins or is first recognized during pregnancy.”

1960s

The Beatles
Go-Go boots
Gestational Diabetes
Positive 1-hour GTT:

- 140 mg/dl or higher
  - Sensitivity of 80%
  - 15% of your patients may require 3-hr OGGT
- 130 mg/dl or higher
  - Sensitivity of 90%
  - 23% of your patients may require 3-hr OGGT
ACOG Diagnostic Criteria for GDM: 2 or more thresholds must be exceeded

<table>
<thead>
<tr>
<th></th>
<th>Serum Glucose by Carpenter /Coustan Conversion</th>
<th>Serum Glucose level by National Diabetes Data Group Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>95 mg/dl</td>
<td>105 mg/dl</td>
</tr>
<tr>
<td>1-hour</td>
<td>180 mg/dl</td>
<td>190 mg/dl</td>
</tr>
<tr>
<td>2-hour</td>
<td>155 mg/dl</td>
<td>165 mg/dl</td>
</tr>
<tr>
<td>3-hour</td>
<td>140 mg/dl</td>
<td>145 mg/dl</td>
</tr>
</tbody>
</table>

“Although a number of comparative studies of various treatments are available, there is little information regarding the effectiveness of treatment versus no treatment.”

RCT to determine whether treating GDM affected perinatal outcomes

At the time, usual practice was no treatment in some centers

1000 pregnant women across 18 centers in Australia and 2 centers in the UK

Positive 2 hour OGTT (FBS>99 mg/dl and 2-hour BS<198 mg/dl)

ACHOIS Trial: 1000 patients

n=510
Positive 2-hour OGTT
Usual care

n=490
Positive 2-hour OGTT
Intervention

# ACHOIS Trial: Outcome Measures

<table>
<thead>
<tr>
<th>Maternal</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Cesarean Delivery</td>
<td>• #PN visits</td>
</tr>
<tr>
<td></td>
<td>• Need for labor induction</td>
<td>• Mode of delivery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Wt. Gain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Antenatal Admits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• PIH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neonatal</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Perinatal complications</td>
<td>• Gestational age</td>
</tr>
<tr>
<td></td>
<td>• Admission to NICU</td>
<td>• Birth Weight</td>
</tr>
<tr>
<td></td>
<td>• Jaundice requiring Photo therapy</td>
<td></td>
</tr>
</tbody>
</table>
## ACHOIS Trial: Neonatal Outcomes

<table>
<thead>
<tr>
<th>Primary</th>
<th>Intervention #(% of n=506)</th>
<th>Routine Care #(% of n=534)</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>7(1)</td>
<td>24(4)</td>
<td>0.32</td>
</tr>
<tr>
<td>Stillbirth</td>
<td>0</td>
<td>5(1)</td>
<td></td>
</tr>
<tr>
<td>Neonatal death</td>
<td>0</td>
<td>3(&lt;1)</td>
<td></td>
</tr>
<tr>
<td>Shoulder Dystocia</td>
<td>7 (1)</td>
<td>16(3)</td>
<td>0.45</td>
</tr>
<tr>
<td>Bone Fracture</td>
<td>0</td>
<td>1(&lt;1)</td>
<td></td>
</tr>
<tr>
<td>Nerve Palsy</td>
<td>0</td>
<td>3(1)</td>
<td></td>
</tr>
</tbody>
</table>

### ACHOIS Trial: Neonatal Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Intervention n=506</th>
<th>Routine n=524</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birth Weight</strong></td>
<td>3335 +/- 551 gms</td>
<td>3482 +/- 660 gms</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>LGA</strong></td>
<td>63 (13%)</td>
<td>115 (22%)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>EFW&gt;4 kg</strong></td>
<td>49 (10%)</td>
<td>110 (21%)</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

ACHOIS Trial: Maternal Outcomes

<table>
<thead>
<tr>
<th>Primary</th>
<th>Intervention # (%) n=490</th>
<th>Routine # (%) n=510</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction</td>
<td>189 (39)</td>
<td>150(29)</td>
<td>1.31</td>
</tr>
<tr>
<td>C/S Total</td>
<td>152 (31)</td>
<td>164(32)</td>
<td>0.96</td>
</tr>
<tr>
<td>C/S Emergent</td>
<td>80 (16)</td>
<td>103 (20)</td>
<td>0.81</td>
</tr>
<tr>
<td>C/S Elective</td>
<td>72 (15)</td>
<td>61 (12)</td>
<td>1.23</td>
</tr>
</tbody>
</table>

ACHOIS: Conclusions

- **Routine Care Group**
  - Increased risk of macrosomia and LGA
  - Increased risk of perinatal outcomes (shoulder dystocia, birth trauma)

- **Intervention Group**
  - Increased risk of labor induction
  - Increased risk of NICU Admission
  - Decreased neonatal body weight

'The USPTF concludes that the current evidence is insufficient to assess the benefits and harms of screening for GDM either before or after 24 weeks gestation.'
HAPO Study 2008

- 25,000 patients in 9 countries
- 75-g OGTT from 24-32 WGA
- Looked at maternal glucose values as a continuum to see what levels may be associated with an increased risk of adverse perinatal outcomes.

Primary Outcomes
- Birth weight > 90%ile
- Primary cesarean delivery
- Clinical neonatal hypoglycemia
- Cord-blood serum C-peptide level > 90%ile

Secondary Outcomes
- Premature delivery
- Shoulder dystocia or birth injury
- NICU admissions
- Hyperbilirubinemia
- Preeclampsia

HAPO Study

Glc >200
- = Overt Diabetes
- Unblinded from study

Glc >105
- GDM
- Unblinded from study

Glc = 2 abnormal values
- Mild hyperglycemia

HAPO Study

- Plasma glucose levels were divided into 7 categories
  - Adjusted Odds Ratios were calculated for both primary and secondary outcomes
  - Then they made some really complicated graphs that I am not going to reproduce because, let’s face it, I am just not that smart.

## HAPO Study: Birth weight > 90th percentile

<table>
<thead>
<tr>
<th></th>
<th>FBS OR</th>
<th>1-hr OR</th>
<th>2-hr OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1.37</td>
<td>1.21</td>
<td>1.11</td>
</tr>
<tr>
<td>3</td>
<td>1.72</td>
<td>1.65</td>
<td>1.51</td>
</tr>
<tr>
<td>4</td>
<td>1.95</td>
<td>2.27</td>
<td><strong>2.15 (126-139)</strong></td>
</tr>
<tr>
<td>5</td>
<td><strong>2.73 (90-94)</strong></td>
<td><strong>2.66 (172-193)</strong></td>
<td>2.10</td>
</tr>
<tr>
<td>6</td>
<td>3.0</td>
<td>3.5</td>
<td>2.68</td>
</tr>
<tr>
<td>7</td>
<td>5.01</td>
<td>4.49</td>
<td>4.46</td>
</tr>
</tbody>
</table>

### HAPO Study: Cord-blood serum C-peptide >90%ile

<table>
<thead>
<tr>
<th></th>
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</tr>
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<tbody>
<tr>
<td>1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1.41</td>
<td>1.07</td>
<td>1.06</td>
</tr>
<tr>
<td>3</td>
<td>1.75</td>
<td>1.62</td>
<td>1.44</td>
</tr>
<tr>
<td>4</td>
<td>2.36 (85-89)</td>
<td>1.95 (156-171)</td>
<td>1.72 (140-157)</td>
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<td>5</td>
<td>3.62</td>
<td>2.76 (172-193)</td>
<td>2.21 (140-157)</td>
</tr>
<tr>
<td>6</td>
<td>4.46</td>
<td>2.91</td>
<td>2.86</td>
</tr>
<tr>
<td>7</td>
<td>7.65</td>
<td>4.65</td>
<td>3.48</td>
</tr>
</tbody>
</table>

HAPO Study: Secondary outcomes

- Positive associations
  - Preeclampsia
  - Shoulder dystocia
  - Birth Injury
HAPO Study: Conclusions

“Our results indicated strong, continuous associations of maternal glucose levels below those diagnostic of diabetes with increased birth weight and increased cord-blood serum C-peptide levels.”

Carpenter-Coustan criteria Vs. National Diabetes Data Group Thresholds

◆ 2009 retrospective cohort study of patients in California delivering from 1988-2001
◆ 14, 500 patients
  ◆ 753 (5.1%) patients meeting criteria for GDM by both NDDG and C-C criteria.
  ◆ 480 (3.3%) by NDDG
  ◆ 272 (1.9%) by C-C
◆ Hypothesized that using the C-C criteria would decrease undesirable perinatal complications.

Cheng, WC, Block-Kurbisch, I. and Caughey, A. Carpenter-Coustan Criteria Compared with the National Diabetes Data Group Thresholds for Gestational Diabetes Mlitus. Obstet and Gynecol. 2009; 114(2)326-332
Cheng, WC, Block-Kurbisch, I. and Caughey, A. Carpenter-Coustan Criteria Compared with the National Diabetes Data Group Thresholds for Gestational Diabetes Millitus. Obstet and Gynecol. 2009; 114(2)326-332
Carpenter-Coustan criteria Vs. National Diabetes Data Group Thresholds

◆ Suggested that NDDG threshold was missing a subgroup of women who had mild hyperglycemia

◆ Suggested that treatment of this subgroup of patients may lower the risk of complications

Cheng, WC, Block-Kurbisch, I. and Caughey, A. Carpenter-Coustan Criteria Compared with the National Diabetes Data Group Thresholds for Gestational Diabetes Mellitus. *Obstet and Gynecol*. 2009; 114(2)326-332
IADPSG 2010

- Made considerable changes to recommendations for screening based primarily on the HAPO Study.
- Goal:
  - Achieve international consensus
  - Translate the HAPO data as it relates to improving perinatal morbidity
**IADPSG Recommendations 2010**

<table>
<thead>
<tr>
<th></th>
<th>&gt;92 mg/dl</th>
</tr>
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<tbody>
<tr>
<td><strong>Fasting Plasma Glucose</strong></td>
<td>&gt;92 mg/dl</td>
</tr>
<tr>
<td>1-Hour Plasma Glucose</td>
<td>&gt; 180 mg/dl</td>
</tr>
<tr>
<td>2-Hour plasma Glucose</td>
<td>&gt; 153 mg/dl</td>
</tr>
</tbody>
</table>

**One or more values must be exceeded.**
IADAPSG Screening Recommendations

First prenatal visit
Measure FPG, A1C, or random plasma glucose on all or only high-risk women

1. If results indicate overt diabetes
   Treatment and follow-up as for preexisting diabetes

2. If results not diagnostic of overt diabetes:
   --and fasting plasma glucose ≥92 mg/dl but <126 mg/dl, diagnose as GDM.
   --and fasting plasma glucose <92 mg/dl, test for GDM from 24 to 28 weeks' gestation with a 75-g OGGT
IADAPSG Screening Recommendations

24–28 weeks' gestation: diagnosis of GDM
2-h 75-g OGTT: perform after overnight fast on all women not previously found to have overt diabetes or GDM during testing earlier in this pregnancy

1. Overt diabetes if fasting plasma glucose 126 mg/dl
2. GDM if one or more values equals or exceeds thresholds
3. Normal if all values on OGTT less than thresholds
No evidence that these changes will lead to clinically significant improvements in maternal and neonatal outcomes.

Could significantly increase costs without improving perinatal, neonatal and maternal outcomes.

DO NOT recommend changing from the current 2-step process until more research is available.

Screening and Diagnosis of Gestational Diabetes Mellitus. Committee Opinion Number 504. ACOG, Obstet Gynecol 2011; 118: 751-53
Why do we care (clinical relevance)?

• Fewer shoulder dystocias
• Fewer NICU admissions
• Decreased childhood and potentially adult obesity
• Less “Birth Trauma.”
• More inductions
• More interventions
• Potentially increased cost
• More patients who will be forced to eat a healthy and balanced diet