Managing Diabetes During Pregnancy and Postpartum

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Where discoveries are delivered."
At the end of this presentation, the participant will

• Understand the changing insulin resistance across gestation and the puerperium
• Describe the normal values for glucose during non-diabetic pregnancy
• Understand the basics of insulin dosing during gestation, labor and inpatient postpartum
Disclaimer and Conflicts

• This webinar is considered a resource, but does not define the standard of care in California. Attendees are advised to adapt the guidelines and resources based on their local facility’s level of care and patient populations served and are also advised to not rely solely on the guidelines presented here.

• I have no conflicts to disclose.
In pregestational* diabetic pregnancy, preventing fetal anomalies is the first concern...

Preconceptional care is essential to prevent birth defects...

Pregestational = Type 1 + Type 2

Where discoveries are delivered.SM
Fetal Anomalies
California Sweet Success Data 2004

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>igt</td>
<td>1%</td>
</tr>
<tr>
<td>GDM</td>
<td>2%</td>
</tr>
<tr>
<td>type 1</td>
<td>7%</td>
</tr>
<tr>
<td>type 2</td>
<td>6%</td>
</tr>
</tbody>
</table>
Anomalies & Early Hba1c

- **HbA1c** Risk
- `< 7%` < 1%
- `7 - 9%` 14%
- `10 - 11%` 23%
- `> 11%` 25%

## Timing of Fetal Anomalies

<table>
<thead>
<tr>
<th>Anomaly</th>
<th>Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spina Bifida</td>
<td>6</td>
</tr>
<tr>
<td>Anencephaly</td>
<td>6</td>
</tr>
<tr>
<td>Cardiac</td>
<td></td>
</tr>
<tr>
<td>Transposition</td>
<td>7</td>
</tr>
<tr>
<td>VSD</td>
<td>8</td>
</tr>
<tr>
<td>ASD</td>
<td>8</td>
</tr>
<tr>
<td>Renal</td>
<td>7</td>
</tr>
</tbody>
</table>

Preconceptional blood sugar control prevents birth defects!!

Smooth preconceptional control makes the bumps of early pregnancy more manageable

After the First Trimester, with Diabetes in Pregnancy It’s About…

- Obesity
- Obesity
- Obesity
- Obesity
Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2013

1/3 of women in the US are Obese

Trends in Child and Adolescent Overweight

Note: Overweight is defined as BMI >= gender- and weight-specific 95th percentile from the 2000 CDC Growth Charts.
Source: National Health Examination Surveys II (ages 6-11) and III (ages 12-17), National Health and Nutrition Examination Surveys I, II, III and 1999-2004, NCHS, CDC.
Are Our Children Becoming Fat Because We Overfeed Them or …

Because they were overfed in the womb and are ‘programmed’ for obesity?
Birthweight
California Sweet Success Data 2004

Macroscopic

-igt: 15%
-GDM: 11%
-Type 1: 20%
-Type 2: 16%
Adult Obesity After Prenatal Diabetes Exposure

Offspring at 27 (4.5 SD) Years of Age by Maternal Metabolic Status
N=597


- GDM
- GDM Risk
- Type 1 DM
- Normals
How does altered fetal nutrition permanently program tissues and regulatory systems?
Pathophysiology of Fetal Obesity in Diabetes

**Maternal**
- Glucose

**Fetal**
- Glucose
- Insulin
- Nutrient Storage
- Macro-somia
- Episodic Hypoxia, Hypertension
- Cardiac, Pulmonary Dysfunction
- Hyper Viscosity Bilirubin
Pregnancy Effects on Glucose and Insulin
Normal Glucose Ranges In Pregnancy

Adapted from (Parretti, Mecacci et al. 2001)
95th Percentile Glucose Ranges In Normal Pregnancy

Adapted from (Parretti, Mecacci et al. 2001)
When Does Glucose Peak in Pregnancy?

Ben Haroush et al, AJOG 2004: 191, 576-81

75 minutes
What Glucose Targets?

Target Glucose Values

• Target BS values should minimize macrosomia (fetal obesity)
• Target values:
  – fasting < 90 mg/dl
  – 1 hour post-prandial < 130 mg/dl
  – OR
  – 2 hour < 120 mg/dl (not)
Factors Affecting Insulin Dosing

- Pregnancy blood volume
- Gestational age
- Time of day
- Fetal growth dynamics
Pregnancy Blood Volume Effects

- Insulin clearance and dose duration is proportional to blood volume and renal clearance.
- Blood volume increases by 40% (5L → 7L).
- Insulin duration is shortened by 30+%

# Insulin Kinetics (Pregnancy)

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Onset of Action (h)</th>
<th>Peak of Action (h)</th>
<th>Duration of Action (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyspro</td>
<td>0.25</td>
<td>1-2</td>
<td>4-5 (2.5)</td>
</tr>
<tr>
<td>Regular</td>
<td>0.5-1.0</td>
<td>2-4</td>
<td>6-8 (4)</td>
</tr>
<tr>
<td>NPH</td>
<td>1-3</td>
<td>4-7</td>
<td>13-18 (10)</td>
</tr>
<tr>
<td>Lente</td>
<td>1-3</td>
<td>4-8</td>
<td>13-20</td>
</tr>
<tr>
<td>Lantus</td>
<td>2-4</td>
<td>8-14</td>
<td>18-30 (20)</td>
</tr>
</tbody>
</table>

Gabbe and Graves, 2005
Advancing Gestational Age:

**Rising Placental Hormones Multiply Insulin Resistance**

- Placental hormones impose **insulin resistance** on maternal tissues
- Rising placental hormones TRIPLE over gestation
- = “The Relentless Escalator”
- Insulin dosing requirements rise linearly to 36 weeks

Moore TR. Diabetes in Pregnancy.
Creasy and Resnik’s Maternal Fetal Medicine 2012
Relative Insulin Needs vs Gestational Age


The Relentless Escalator!
Time of Day Effects: Daily Maternal Cortisol Rhythm

9#14oz, cesarean
Designing Basal Strategies

- Enough insulin to keep pre-meal BG 80-100
- Provide adequate insulin for ‘high resistance’ periods (6 AM -- 9 AM)
- Keep basal insulin low during ‘low resistance’ periods (11 PM – 4 AM)
- Avoid hypoglycemia which causes corrections, over eating, catechol release
Designing Bolus Strategies

- Keep 1 hr PP < 130 mg/dl
- Adapt to carb content of the meal
- Take into account pre-meal BG
- Bolus does not ‘hang around’ more than 2 hours post eating in pregnancy
- In 3rd trimester, AM bolus may require a delay of 15-30’ before eating
Four Well Controlled HbA1c < 7

Total Insulin Changes During Gestation in Type 1 Diabetes

Making Insulin Changes

- 7 days of data (at least 3 days)
- BG record: fax, photo, email
- Dietary Recall
- Phone call or phone message OK
- Office visit, face to face q 2-3 weeks
  - (Spouse/significant other)
  - Sketch out all changes, discuss
  - Then enter into pump and/or give instructions in writing
1. Do basals first
2. Avoid 03-04 AM hypoglycemia by adjusting 00-05 basal
3. Adjust FBG (70-90) by changing the 05-09 basal
4. Adjust Pre-Lunch (80-100) using the 09→ basal
5. Adjust Pre-Dinner using the appropriate basal
6. Adjust HS with appropriate basal

<table>
<thead>
<tr>
<th>Times of Day Glucose Tested &amp; Results Basal Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month</td>
</tr>
<tr>
<td>3 AM - 5 AM</td>
</tr>
<tr>
<td>Fasting Before Brkfst</td>
</tr>
<tr>
<td>After Breakfast</td>
</tr>
<tr>
<td>Before Lunch</td>
</tr>
<tr>
<td>After Lunch</td>
</tr>
<tr>
<td>Before Dinner</td>
</tr>
<tr>
<td>After Dinner</td>
</tr>
<tr>
<td>HS</td>
</tr>
</tbody>
</table>
Diabetes Management: Intrapartum and Postpartum

- GDM and Type 2 on oral meds: stop oral meds before induction or in labor; withhold glucose from IV; restart PP if glucoses abnormal; PP diet – emphasize choice

- Pregestational Intrapartum:
  - glucose + insulin infusion protocol
  - Start before oxytocin

- Postpartum:
  - Maintain infusion until taking PO well
  - Starting doses: 1/3 of pre-delivery
  - Pump: Day 1-2 0.3 U/hr 1:15 U/g Carb
  - Day 3+ 0.3/0.45/0.4 1:12, 1:15, 1:15
  - Diet: emphasize choice; avoid ‘Diabetic Diet’ with sugar-free syrup on pancakes
Pregestational Diabetes: Postpartum Philosophy

- Postpartum ward and hypoglycemia can be dangerous
- Pregestational patients should check own glucose
  - Follow hospital protocols
- Pregestational patients should bring an ‘emergency backpack’
  - Glucose tabs, juice boxes, cheese/peanut butter crackers, nuts
- Insulin orders should emphasize liberal glucose control
  - FBG 80 – 110
  - 1 hr PP 100 – 180
  - Correction 1U for > 180, recheck 1 hour
- Diet orders should emphasize choice
  - Beware ‘diabetes’ or ‘ADA’ diets: pancakes with sugar-free syrup
A healthy bottom line.