2020: WHAT’S NEW IN PREGNANCY COMPLICATED BY DIABETES?

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Objectives

At the end of this presentation, the attendee will be able to:

• Describe current guidelines for the preconception management of women with preexisting diabetes
• Describe current guidelines for the management of women with preexisting diabetes
• Describe current guidelines for the management of women with gestational diabetes
Pregnancy …

At no other time in a woman's life is glycemic control more important…
Pregnancy ...

... and at no other time in her life is a woman more motivated to achieve it!!
Diabetes

Diabetes is defined as a chronic metabolic disease characterized by hyperglycemia:
- caused either by impaired or lack of insulin production
- deficient insulin action or utilization
- a combination of these factors
Pre-existing Diabetes

- Type 1 or type 2 diabetes
- Affects about 1-2% of all pregnancies
TYPE 1 DIABETES

- About 5% of diabetics
- Onset most common in children, teens, and young adults
- Can develop at any age
- End organ damage-retinopathy, neuropathy, vasculopathy
- Need exogenous insulin to survive
TYPE 2 DIABETES

- 90-95% of diabetics
- Adult onset—usually after age 45
- More children and teens developing type 2
- As obesity increases, so does rate of type 2
- Caused by
  - Progressive insulin resistance
  - Diminished insulin secretion
Perinatal Mortality

- Rate of spontaneous abortion estimated at 30-60%
- Rate of congenital anomalies still 6-12% compared to 2-3% seen in the general population
What can be done to prevent or decrease the rate of spontaneous abortions and congenital anomalies?
PRECONCEPTION COUNSELING!
BEST ANTEPARTUM CARE IS PRECONCEPTION CARE!
Spontaneous Abortions

*Diabetes in Early Pregnancy Study*

Higher the A1c at conception, higher the risk of SAB, beginning at the upper limit of normal
Spontaneous Abortions

Women with normoglycemia preconceptually can virtually eliminate pregnancy losses associated with diabetes!
Congenital Anomalies

- Birth defects most often associated with diabetes occur during organogenesis
- That’s before the 8th week of gestation!
## Table 3. RISK FOR MAJOR OR MINOR CONGENTIAL ANOMALY BASED ON PERICONCEPTIONAL A1C (8)

<table>
<thead>
<tr>
<th>Standard deviation from mean</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>≥ 12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated A1c (%)</strong></td>
<td>5.5</td>
<td>6.2</td>
<td>6.9</td>
<td>7.6</td>
<td>8.3</td>
<td>9.0</td>
<td>9.7</td>
<td>10.4</td>
<td>11.1</td>
<td>11.8</td>
<td>12.5</td>
<td>13.2</td>
<td>≥ 13.9</td>
</tr>
<tr>
<td><strong>Abnormality risk (%)</strong></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>17</td>
<td>20</td>
</tr>
</tbody>
</table>

Guerin 2007
## Congenital Anomalies

<table>
<thead>
<tr>
<th>Congenital Malformations in Infants of Diabetic Mothers</th>
<th>Ratio of Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caudal Regression</td>
<td>252</td>
</tr>
<tr>
<td>Spina Bifida, hydrocephalous, or other CNS defects</td>
<td>2</td>
</tr>
<tr>
<td>Anencephalus</td>
<td>3</td>
</tr>
<tr>
<td>Heart anomalies</td>
<td>4</td>
</tr>
<tr>
<td>Anal/rectal</td>
<td>3</td>
</tr>
<tr>
<td>Renal Anomalies</td>
<td>6</td>
</tr>
<tr>
<td>Agenesis</td>
<td>7</td>
</tr>
<tr>
<td>Cystic Kidney</td>
<td>4</td>
</tr>
<tr>
<td>Ureter Duplex</td>
<td>23</td>
</tr>
<tr>
<td>Situs Inversus</td>
<td>84</td>
</tr>
</tbody>
</table>

![Congenital Anomalies Image]
Preconception Counseling

- Goals of preconception care
  - A1C ideally less than 6.5% to 7%
Preconception Counseling

- MD consult to explain risks of pregnancy on diabetes and risks of diabetes on pregnancy
- RD for meal plan
- RN for blood glucose monitoring and insulin administration education
- SW for support, resources
Preconception Counseling

What about women with type 2 diabetes?

- Oral agents NOT recommended for use during pregnancy
- Insulin is THE gold standard!
Medications

- Antidiabetes meds cross the placenta—may cause fetal hyperinsulinemia
- ACE inhibitors, ARBs and statins all teratogenic
- Should be changed or d/c’d
Preconception Counseling

Starting when?
WHAT'S THE RISK?

TO MOM???

TO BABY???
Maternal Morbidity

- Increased risk of hypertensive disorders of pregnancy
- Increased rate of PTL, C/S
- Significant renal, ophthalmologic or hypertensive disease that can progressively worsen to irreversible state
- Hypoglycemia, DKA
Maternal Morbidity

- Women with CHTN & nephropathy have increased risk of pregnancy complications
- Preterm birth, preeclampsia, FGR, and stillbirth
Maternal Morbidity

Studies show that women with severe baseline nephropathy may experience permanent worsening in renal function.

Pregnancy may be contraindicated in women on dialysis.
Maternal Morbidity

- Symptomatic coronary artery disease may be a contraindication to pregnancy
- Pregnancy-related hemodynamic changes may result in myocardial infarction and death
Fetal Morbidity

- Spontaneous abortions
- Fetal anomalies
- Fetal demise, stillbirth
- Intrauterine growth abnormalities (FGR, macrosomia)
- Fetal hypoxemia from chronic hyperinsulinemia/hyperglycemia
Neonatal Morbidity

- SGA, LGA
- Metabolic derangements
  - Hypoglycemia, hyperbilirubinemia
- Shoulder dystocia, birth trauma
- Respiratory distress syndrome
WHAT’S A PROVIDER TO DO?
Early Pregnancy or Prepregnancy

- To assess degree, if any, of diabetic complications
- For baseline comparison should complications of pregnancy occur
Early Pregnancy or Prepregnancy

- Renal: U/A, C/S, BUN, creatinine, albumin-creatinine ratio (or 24 hr)
- Ophthalmological: Retinal examination, laser therapy prn
- Cardiovascular: EKG, BP
- Thyroid function studies
Early Pregnancy or Prepregnancy

- Folic acid—at least 400 ug daily
- Genetic counseling: risks described, screening options offered
- Early ultrasound for viability and dating
Honey, I’m Pregnant!

- Women present for care AFTER the pregnancy is discovered about 2/3 of the time!
- Hospitalization may be recommended to reduce blood glucose levels rapidly
<table>
<thead>
<tr>
<th>Blood Glucose</th>
<th>Type 1 DM</th>
<th>ml/hr</th>
<th>Type 2 / GDM</th>
<th>ml/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;70</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>70-90</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>91-110</td>
<td>1.0</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>111-130</td>
<td>1.5</td>
<td>1.5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>131-150</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>151-170</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>171-190</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Notify MD and Adjust if 2 values out of range.
Metabolic Alterations During Pregnancy

“Accelerated starvation”

- Blood glucose drops lower in fasting state
- Higher and more prolonged blood glucose levels in fed state
Fasting State in Normal Pregnancy

**Graph:**
- **Y-axis:** Glucose (mg/100ml)
- **X-axis:** Duration of Fast (Hours)
- **Legend:**
  - Non-pregnant
  - Pregnant
- **Key Points:**
  - **P<.001**
  - Data points at 12, 36, 60, and 84 hours

**Summary:**
- Glucose levels decrease significantly over time in both non-pregnant and pregnant states.
- The decrease is more pronounced in pregnant compared to non-pregnant states.
- The difference is statistically significant at each time point.
Daily Glucose Excursions: Pregnant vs Nonpregnant

Glucose (mg/dl)
Metabolic Alterations During Pregnancy

- Morning sickness and food intolerance contribute to maternal hypoglycemia
- Blood sugar control very unstable
- Hypoglycemia very common
Metabolic Alterations During Pregnancy

Second & Third trimester

- Human placental lactogen, progesterone, prolactin, placental growth hormone, and cortisol cause insulin resistance
- About 36 weeks: hormone levels and BS stabilize
Gestational Diabetes

- Diabetes first diagnosed in the second or third trimester of pregnancy that is clearly not preexisting type 1 or type 2 diabetes
- Affects 2-10% of pregnancies
BMI > 25 (> 23 in Asian Americans)
Family history of diabetes
High risk ethnic group:
  - African American
  - Native American
  - Hispanic/Latina
  - Pacific Islander
  - Asian American
Maternal birthweight
  - SGA or LGA
Hypertension
History of GDM in prior pregnancy

Age above 25
Polycystic ovary syndrome
Physical inactivity
Other clinical conditions associated with insulin resistance
Medications that raise BG levels
Obstetric history of LGA baby, stillbirth, or birth defects
Maternal Risks with GDM

- Increased risk of hypertensive disorder, preeclampsia
- Increased risk of cesarean delivery
- Emotional, psychological, financial
Maternal Risks

...and

Approximately 70% of women with GDM will develop T2DM
Hyperglycemia and Adverse Pregnancy Outcome Study

- International observational study of 23,325 pregnant women at 15 centers in nine countries
- All had 75-gram 2-hr OGTT at 28 weeks
- Results blinded unless values exceeded predefined cutoff points
- At what level on OGTT do adverse outcomes appear?

HAPO, NEJM, 2008
Hyperglycemia and Adverse Pregnancy Outcome Study

- As blood glucose levels macrosomia, C/S, neonatal hypoglycemia
- Adverse outcomes a continuum, even in ranges previously considered normal
- Cannot determine exactly what level of blood glucose is clinically important or which should be considered abnormal

HAPO, 2008
Testing for GDM

- Universal testing
- All women at 24-28 weeks gestation
- Use of historical risk factors will miss ½ of women with GDM
- Risk assessment at first prenatal visit
Test for Type 2 Diabetes-ADA

BMI > 25 (> 23 in Asian Americans)

Previous History of:
  Gestational diabetes or prediabetes
  Macrosomia
  Unexplained still birth, birth defect
  Cardiovascular disease
History of overt DM in parents, siblings, children
Hypertension
Glycosuria
Medications that increase glucose intolerance
CONTINUED…
Test for Type 2 Diabetes-ADA

High risk ethnic group:
- African American
- Native American
- Hispanic/Latina
- Pacific Islander
- Asian American

Polycystic ovary syndrome
Physical inactivity
HDL <35, TG >250
Diagnose Type 2 Diabetes
ADA, 2020

Table 2.2—Criteria for the diagnosis of diabetes

<table>
<thead>
<tr>
<th>FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
</tr>
<tr>
<td>2-h PG ≥200 mg/dL (11.1 mmol/L) during OGGT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water.*</td>
</tr>
<tr>
<td>OR</td>
</tr>
<tr>
<td>A1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*</td>
</tr>
<tr>
<td>OR</td>
</tr>
<tr>
<td>In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).</td>
</tr>
</tbody>
</table>

*In the absence of unequivocal hyperglycemia, diagnosis requires two abnormal test results from the same sample or in two separate test samples.
Two GDM Screening Options

- **One step**
  - 75 gram OGTT

- **Two Step**
  - 50 gram load if +
  - 100 gram OGTT
75 Gram OGTT
ONE STEP TEST

- Fasting test

<table>
<thead>
<tr>
<th>FBS</th>
<th>1 hour</th>
<th>2 hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 92</td>
<td>&gt; 180</td>
<td>&gt; 153</td>
</tr>
</tbody>
</table>

- 1 value = positive screen
TWO STEP

Step One-Diabetic Screen (GCT)

- 50 gram glucose challenge
- BS one hour later
- No need to fast

ACOG, 2018
Interpreting Results
1hr GCT

- If blood sugar > 140, OGTT will pick up 80% of cases of GDM
- If blood sugar > 130, OGTT will pick up 90% of cases of GDM
- If blood sugar > 200 (183), diagnose GDM without OGTT
  - May do FBS-if > 95-dx GDM
Step Two: Oral Glucose Tolerance Test (OGTT)

- Normal amount (175g/day) of CHO before test
- NPO 10-14 hours
- FBS drawn, 100g glucose load, blood sugar drawn at 1, 2, & 3 hours
## Normal Values OGGT

<table>
<thead>
<tr>
<th>NDDG</th>
<th>C &amp; C</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBS &lt; 105</td>
<td>FBS &lt; 95</td>
</tr>
<tr>
<td>1 HR &lt; 190</td>
<td>1 HR &lt; 180</td>
</tr>
<tr>
<td>2 HR &lt; 165</td>
<td>2 HR &lt; 155</td>
</tr>
<tr>
<td>3 HR &lt; 145</td>
<td>3 HR &lt; 140</td>
</tr>
</tbody>
</table>
Interpreting Results
3hr OGTT

- If two values are elevated, diagnose GDM
- If one value is elevated, repeat OGTT in 1 month
- 34% will have 2 elevated values on second OGTT

Neiger & Coustan, AJOG, 1991
Interpreting Results
3hr OGTT

- One abnormal value
  - Maternal and fetal risks significantly higher than those women without GDM
  - MFMU Mild GDM study Langdon, 2009
    Women with 2 abnormal values, but FBS <95
    Treatment improved outcomes

- ACOG: ok to dx GDM if 1 abnormal value

ACOG, Number 190, 2018
Screening in Unusual Cases

Bariatric surgery clients- Most will not tolerate a glucose load

Hyperemesis

SO

FBS and 1 hour pp blood glucose level checked at 22- 24, 28-32, and 34 weeks gestation

FBS and 1 hour pp blood glucose for 1 week with a blood glucose meter on her usual diet

IV GTT
Antepartum Management
Medical Nutrition Therapy

- The manipulation of food choices to achieve target glucose goals
- Provides adequate nutrition to support pregnancy
- Integrates results of self blood glucose monitoring (SBGM)
Components of Medical Nutrition Therapy

- Weight gain
- Calorie Level
- Carbohydrates
- Protein
- Fat
- Sweeteners
Nutrient Distribution

- Carbohydrate: 40 - 45 % of total calories
- Protein: 20 - 25 % of total calories
- Fat: 30 - 40 % of total calories
- Total: 1900-2500 kcal/day
Carbs are NOT BAD!
Carbohydrates

- Includes food in the following groups
  - Sugar, fruit, milk, grains, starchy vegetables, legumes

- Both sugar and starch turn to blood sugar and enter our blood stream
- Choose healthy carbs-RDA 175g/day
Carbohydrates

- Carbohydrate should be distributed evenly through the day
- 3 moderate sized meals and 2 to 4 healthy snacks
- A bedtime snack, containing carbohydrate and protein, may be required to prevent overnight ketosis
No Only Protein Diets Please!!!
Protein

Animal Protein:
- Meat (beef, pork, lamb, goat, etc.)
- Fish & seafood
- Poultry
- Cheese
- Eggs
- Milk and yogurt

- Nuts
- Seeds
- Tofu
- Soy (soybeans, soy milk)
- Beans (black, kidney, pinto, chickpeas, etc.)
- Peas & lentils
Fat

- 30 – 40% kcals/day in GDM
- Emphasis on healthy fats. Monounsaturates encouraged:
  - olive, canola oils
  - avocado
  - olives
  - peanuts, walnuts
Food Focus Points

- Eat every 2-3 hours include protein
- Drink zero calorie beverages
- Make sure to limit caffeine
- Keep a food diary to look for trends
Home Glucose Monitoring

- BS tested at least QID throughout pregnancy-FBS and 1-2 hrs pp
- Some prefer FBS, premeal, 1-2 hrs pp, and bedtime
- Occasional 2-3am
Home Glucose Monitoring

- Meter with memory used
- BS reviewed with Diabetes Clinician or MD twice weekly
- If BS WNL, may test QOD
# Glucose Goals During Pregnancy

<table>
<thead>
<tr>
<th>Time</th>
<th>Plasma Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBS</td>
<td>65-105 (&lt;95)</td>
</tr>
<tr>
<td>1 hr pp</td>
<td>115-155</td>
</tr>
<tr>
<td>2 hr pp</td>
<td>120-130 (&lt;120)</td>
</tr>
<tr>
<td>2am-6am</td>
<td>65-135</td>
</tr>
</tbody>
</table>
Continuous Glucose Monitoring

- Professional or Personal models
- Dexcom G6-Clarity
- Guardian Connect
- Freestyle Libre and Libre 2-Libre View
- Eversense
Continuous Glucose Monitoring
Exercise in Pregnancy

- If no medical or obstetrical contraindications
- Increases insulin sensitivity and glucose utilization
- Maintains muscle tone
- Best if done after a meal
Insulin Therapy

Insulin is the “Gold Standard”
- One to four doses daily, depending on which BS are elevated
- Insulin pump
## Types of Insulin

<table>
<thead>
<tr>
<th>Type</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lispro, Aspart, Glulisine</td>
<td>15 min</td>
<td>1-2 hrs</td>
<td>3-5 hrs</td>
</tr>
<tr>
<td>Short acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular (R)</td>
<td>30-60 min</td>
<td>2-4 hrs</td>
<td>5-8 hrs</td>
</tr>
<tr>
<td>Intermediate acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH, Detemir</td>
<td>1-3 hrs</td>
<td>6-12 hrs</td>
<td>18-24 hrs</td>
</tr>
<tr>
<td>Long acting (U)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glargine, Degludec</td>
<td>4-6 hrs</td>
<td>8-20 hrs</td>
<td>24-28 hrs</td>
</tr>
<tr>
<td></td>
<td>1 hour</td>
<td>None</td>
<td>24 hrs</td>
</tr>
</tbody>
</table>
Other Insulin Preparations

- Regular Insulin 500 units/cc
- Humalog (lispro) 200 units/cc
- Toujeo (glargine) 300 units/cc
- Less volume of liquid to inject
Insulin Therapy

- Weight-based insulin dosing:
- Current weight (kg) X total daily requirement based on GA=Total daily dose (TDD)

<table>
<thead>
<tr>
<th>Weeks Gestation</th>
<th>Total Daily Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1-18</td>
<td>0.7u/kg</td>
</tr>
<tr>
<td>Week 18-26</td>
<td>0.8u/kg</td>
</tr>
<tr>
<td>Week 26-36</td>
<td>0.9u/kg</td>
</tr>
<tr>
<td>Week 36-40</td>
<td>1.0u/kg</td>
</tr>
</tbody>
</table>
Insulin Therapy

- JD is 30 weeks EGA, currently 220 lbs
- FBS 98-105
- 2 hr pp BS 110-164
- Start insulin? How much?
  - 100 kg X 0.9 u/kg
  - TDD=90 units
Insulin Therapy

- 2/3 prebreakfast = 60 units
  - 2/3 NPH = 40 units; 1/3 Reg or H = 20 units
- 1/3 pre-dinner = 30 units
  - 1/2 NPH = 15 units; 1/2 Reg or H = 15 units
Insulin Therapy

- Targeted doses
- Elevated fastings-N at hs
- Elevated after only 1 meal-rapid acting insulin premeal
Insulin Therapy - Pens

Much easier for patients to use

Not always possible to achieve tight control with premixed insulin
Insulin Therapy-Pumps

- May provide better glycemic control
- Provide easier dose adjustments for:
  - Nocturnal hypoglycemia
  - Morning sickness and illness
  - Hormonal changes
  - Breastfeeding
Insulin Therapy-Pumps

- Infusion sites should be changed every 24-48 hours
- May need to use sites other than the abdomen by the end of pregnancy
- Blood sugars should be tested premeal, postmeal, bedtime, and occasionally at 2-3am OR continuous glucose monitoring
Insulin Pump with CGMS
Tandem T-slim

Saturday Sep 14, 2019

Wednesday Sep 18, 2019
Diabetes Apps
Hyperglycemia

- Insulin doses increased 10-20% if glucose levels above targets
- Insulin doses may double or triple prepregnancy doses
Hyperglycemia

- Diabetic ketoacidosis can occur rapidly and at lower glucose levels during pregnancy
- Seen in 5-10% of pregnancies complicated by diabetes
- DKA during pregnancy can cause fetal demise in about 50% of cases
Hyperglycemia

- Check urine ketones for glucose levels above 200 mg/dl
- If more than trace ketones, call health care team
Antepartum Management
Glyburide in GDM

- A sulfonylurea-stimulates pancreas to secrete more insulin
- First RCT, n=404, Insulin vs Glyburide
- Glyburide not detected in cord serum
- Glyburide: a “cost-effective, patient-friendly” alternative to insulin therapy

Langer, NEJM, 2000
METFORMIN IN GDM (MiG) STUDY

- 751 women with GDM treated with insulin or metformin
- 363 took metformin-46% required supplemental insulin
- Metformin d/c’d in 7.4% women

Rowan, 2008
Oral Agents in GDM

- Both glyburide and metformin cross the placenta

- RCTs support efficacy and short term safety

- Metformin likely crosses to a greater extent than glyburide
Oral Agents in GDM

- Glyburide associated with higher rate of neonatal hypoglycemia and macrosomia
- Metformin associated with lower risk of hypoglycemia, less maternal weight gain, slightly increased risk of prematurity
- If metformin used in women with PCOS to induce ovulation, it can be discontinued when pregnancy is confirmed
  - No evidence of preventing SAB or GDM

Balsells, 2015; Palomba, 2005
Oral Agents in GDM-ACOG

- Metformin is a reasonable alternative choice in women who
  - Decline insulin therapy
  - Cannot afford insulin
  - Provider believes is unable to safely prepare and administer insulin

- Glyburide should not be first choice
  - It doesn’t yield equivalent outcomes to insulin or metformin

ACOG, 2018
Oral Agents in GDM

NONE of these agents are approved by the FDA or ACOG for use in pregnancy

NO long term safety data
Hypoglycemia

- Very rare in women with gestational diabetes, even on insulin or glyburide
- Usually due to skipped meal or snack
Hypoglycemia

Prevention:
- Eat meals & snacks same time each day
- Protein with every meal & snack
- GIVE RX GLUCAGON-type 1
- Someone ELSE has to learn how to give it
Sick Day Management

- Illness, stress can increase BS levels, affect eating habits
- Patient CANNOT stop taking insulin!
- Test BS every 2-4 hours
- DKA can happen in hours
Sick Day Management

- Eat small, frequent meals or liquids with 10-15g CHO
- Check ketones
- May require IV hydration
- May require hospitalization
Throughout Type 1 & 2 Pregnancy

- BP, urine protein monitored closely
- Nuchal translucency scan
- Expanded AFP (Quad Screen) at 15-20 weeks to screen for neural tube defects
- Level II Ultrasound 18-20 weeks
- Fetal echocardiogram at 20-22 weeks
Throughout Type 1&2 Pregnancy

- Periodic ultrasounds for growth, Amniotic Fluid Volume, Estimated Fetal Weight
- Daily fetal movement counting-Kick Counts
Throughout Type 1 & 2 Pregnancy

- Fetal evaluation weekly at about 30-34 weeks, increasing to twice weekly
  - NonStress Test, Biophysical Profile, Contraction Stress Test
- Doppler velocimetry of umbilical artery for poor fetal growth or in women with vascular complications
Complications of Pregnancy

- Preeclampsia and GH twice as frequent than in non-diabetics
  - More likely if diabetes more severe or have poor glycemic control
  - More likely if chronic hypertension and/or nephropathy are present
Complications of Pregnancy

- Pre-term labor occurs in about 30% of overt diabetics
  - Magnesium sulfate tocolytic of choice
  - Terbutaline and steroids increase BS, can cause DKA
Complications of Pregnancy

- Spontaneous preterm labor and delivery more common
- Higher incidence of macrosomia, IUGR, stillbirth
  - Macrosomia: birthweight > 4000 grams
  - IUGR: birthweight < 10th percentile
Fetal Evaluation

Type 1, Type 2, GDM on Insulin or with Poor Glucose Control

- NST/AFI 2x weekly, beginning at 32 weeks or earlier
- U/S for EFW late in 3rd trimester
- ? Admission for glycemic control
Timing of Delivery

- Fetal well-being is reassuring and BG levels well controlled on medication, deliver at 39-39 6/7 weeks
- Poorly controlled diabetes
  - Weigh risk of prematurity against risk of stillbirth
  - 37-38 6/7 weeks may be justified
  - 34-36 6/7 weeks for
    - Failed in-hospital attempts to improve glycemic control
    - Abnormal antepartum fetal testing

ACOG, 2018
Timing of Delivery

- Fetal lungs mature more slowly in women with diabetes
- Delivery indicated without lung maturity if life of either is in jeopardy
- DM itself is not an indication for preterm or Cesarean delivery
Mode of Delivery

- Vaginal delivery is preferable
- Rate of Cesarean delivery is significantly higher than in women without diabetes
- Cesarean section considered if EFW >4500g
Honey, It’s Time!
Honey, It’s Time!

- Labor is exercise-lowers glucose levels and insulin requirements!
- Goal: maintain euglycemia (70-120 mg/dl)
- Continuous fetal monitoring
Spontaneous Labor

- Baseline plasma glucose on meter and by lab for correlation
- Test BS every hour
- Maternal vital signs, I & O
- Check urine for ketones
- Monitor for signs and symptoms of hypoglycemia, DKA
Induction of Labor or Planned Cesarean Section

- Usual dose of insulin night before
- Withhold am dose of insulin and breakfast
- Schedule for early am
- Start IV fluids and blood glucose monitoring
Postpartum Type 1 & 2

- Loss of placental hormones causes precipitous drop in insulin requirements
- “Honeymoon period” 48-72 hrs postpartum
- Women with type 2 diabetes can start taking oral agents again
Post Partum GDM

- Loss of placental hormones causes loss of insulin resistance
- No more diet, insulin, or BS testing!
Post Partum GDM

- Post-partum OGTT 4-12 weeks after delivery
- Women with IFG, IGT or t2DM referred for preventative or medical therapy
- Repeat testing every 1-3 years
  - A1c
  - FBS
  - 2 hr OGTT
LONG TERM MATERNAL CONSEQUENCES

- ~66% will develop GDM in subsequent pregnancies
- ~50-70% will develop Type 2 Diabetes
  - 15-25 years after pregnancy
  - 60% of Latin American women within 5 years

ADA, 2018
What About the Baby?
Newborn Complications

- Birth injury, usually due to macrosomia
  - Shoulder dystocia, Erb’s palsy
- Hypoglycemia (<40mg/dl)
  - Due to poor glycemic control
  - High blood sugars at delivery
Newborn Complications

- Respiratory distress, asphyxia
  - Due to lung immaturity
- Hyperbilirubinemia, Hypocalcemia
- Hypomagnesia, polycythemia
Long Term Consequences

• Mom with type 1 diabetes-risk to offspring about 1-4%
• Dad with type 1 diabetes-risk to offspring about 6%
• Family history of type 2 diabetes-rate depends on ethnicity
Breastfeeding with Diabetes

- Women with diabetes may have more difficulty establishing and maintaining lactation
- Higher rate of Cesarean sections than general population
- Infant usually separated from mom at birth for observation
Breastfeeding with Diabetes

- Onset of milk secretion delayed in women with diabetes
- Blood glucose levels may be more variable
- Approximately same meal plan as third trimester to meet caloric needs
Breastfeeding with Diabetes

- Hypoglycemic reactions common, especially during the night
- Less insulin usually required due to calories spent breastfeeding
- More prone to mastitis
Breastfeeding with Diabetes

- Hormonal changes, emotional shifts, irregular sleep patterns, and fatigue may mask or change symptoms of high or low blood glucose
- Test glucose levels more often, 2 am
- When in doubt, TEST!
Breastfeeding with Type 2 DM

- Most antidiabetes agents not recommended for use during lactation
- Some shown to cross in human breast milk, some found in milk of lactating rats, some unknown
- Hypoglycemia is a potential toxicity
Breastfeeding with Oral Agents

- Glyburide and glipizide
  - Not detected in breast milk
  - Hypoglycemia not observed in infants

- Metformin studies
  - Excreted in breast milk
  - Amount appears to be clinically insignificant
Breastfeeding with GDM

- Decreases Mom’s risk of type 2 DM
  - 6 months cuts risk in half
  - May add up with multiple pregnancies

- Decreases baby’s risk of type 2 DM
  - Cuts risk of childhood obesity
POST-PARTUM OGTT
4-12 weeks PP

- NPO 10-14 hours
- FBS drawn, 75g glucose load, glucose 2 hours later
- Normal values:
  - FBS < 100
  - 2 hour < 140
Diagnose Type 2 Diabetes
ADA, 2020

**Table 2.2—Criteria for the diagnosis of diabetes**

FPG ≥ 126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*

OR

2-h PG ≥ 200 mg/dL (11.1 mmol/L) during OGGT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water.*

OR

A1C ≥ 6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*

OR

In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥ 200 mg/dL (11.1 mmol/L).

*In the absence of unequivocal hyperglycemia, results should be confirmed by repeat testing.
ADA DIAGNOSTIC CRITERIA
PRE-DIABETES

- Impaired Fasting Glucose:
  FBS $\geq 100$ and $\leq 125$
- Impaired Glucose Tolerance: 2hr value $\geq 140$ & $< 200$
- A1C 5.7-6.4%
DIABETES PREVENTION PROGRAM

- 3234 adults with IGT randomized to placebo, metformin or lifestyle modification
- Metformin decreased incidence of type 2 diabetes by 31%
- Lifestyle modification decreased incidence of type 2 diabetes by 58%
DIABETES PREVENTION PROGRAM

- 350 women in DPP had history of GDM
- Either Intensive lifestyle or metformin therapy placebo group
- Data suggest that metformin may be more effective in women with a history of GDM

Ratner, 2008
DIABETES PREVENTION EDUCATION

- National Diabetes Education Program
- Structured plan for prevention of type 2 diabetes
- Assists participants to implement DPP recommendations
- www.ndep.nih.gov
The Good News

Improved glycemic control is associated with a significant reduction in obstetric and neonatal complications in women with diabetes!