DIABETES IN PREGNANCY

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UPDATED AND PRESENTED BY: KRISTI EICHHORN MSN, CNM, WHNP-BC, AWHONN FHM INSTRUCTOR

OBJECTIVES

At the conclusion of this session participants will be able to:

 Define gestational diabetes
 State 3 maternal-fetal complications of poor glucose control before and during pregnancy
 Discuss the use of diet, exercise, self glucose monitoring, and medications to control blood glucose levels
 Discuss common diabetic medications used in pregnancy and postpartum, and list 3 treatments for hypoglycemia.

DEFINITIONS

 Diabetes Mellitus (DM)
 A group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. - ADA

 Gestational Diabetes Mellitus (GDM)
 Any degree of glucose intolerance with onset or first recognition during pregnancy.

 Diabetes Mellitus (DM)
 A group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. - ADA
DIABETES STATISTICS

- 30.3 million Americans have Diabetes
- 84.1 million Americans have Pre-Diabetes
- 7th leading cause of death in the U.S.
- $245 billion: Total costs of diabetes in the U.S.
- Type 2 Diabetes in children has increased by 20% in the past decade
- 1.85 million women of reproductive age (18-44) have diabetes
- 6-9% of all pregnancies are complicated by diabetes
- 90% Gestational Diabetes
- 10% Pre-gestational diabetes

ACCORDING TO THE INTERNATIONAL DIABETES FEDERATION (IDF)

- Every 6 seconds a person dies from diabetes
- 1 in 2 (46%) people with diabetes are undiagnosed
- 1 in 7 births is affected by GDM
- The greatest number of people with diabetes are between 40 and 59 years
- By 2040, 1 adult out of 10 will have diabetes

Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2015

TYPE 1 DIABETES

- Type 1 diabetes (5%)
  - Usually first diagnosed in children & young adults (<20)
  - More common in Caucasian
  - Equally affects men & women
  - Autoimmune disease that attacks insulin producing cells (Betas) in the pancreas, caused by genetic, environmental, or other factors
  - No insulin or limited insulin produced
  - Must take insulin daily to survive

TYPE 2 DIABETES

- Type 2 diabetes - Most common form of DM (90%)
  - Insulin resistance and usually a small amount of insulin deficiency
  - Hyperglycemia may occur over years and may go undiagnosed for years
  - Strong genetic disposition
  - High correlation with obesity & lack of physical activity
  - Onset typically after 40 years old
  - Preventable or controlled through healthy eating, lowering body weight, & increasing physical activity
  - May require oral agents or insulin
  - More common in men
  - Less weight gain needed to cause insulin resistance

RISK FACTORS FOR TYPE 2 DIABETES

- Family history
  - 1st degree relative
- Obesity
  - BMI > 27
- Sedentary lifestyle
- Age
  - 40-45 or older
- Race/Ethnicity
  - Hispanic, African American, Native American, Asian-American, Pacific Islander
- Hypertension
  - 140/90 or greater
- HDL cholesterol level
  - 35mg/dL or less
- Triglyceride level
  - 250 mg/dL or greater
- History of GDM or baby >9lbs
**DIABETES STANDARD DIAGNOSTIC CRITERIA (ADA 2016)**

- FBG 126 mg/dL or greater
- 2hr GTT 200 mg/dL or greater
- A1C 6.5% or greater
- If symptoms of hyperglycemia present & a random glucose of 200 mg/dL or greater
- Low C-peptide associated with Type 1 DM

**PREDIABETES & METABOLIC SYNDROME**

- **Prediabetes:**
  - Impaired Fasting Glucose (IFG): 100-125 mg/dL
  - 2hr GTT 140-199mg/dL
  - A1C 5.7-6.4

- **Metabolic Syndrome:**
  - Cluster of conditions that occur together, increasing the risk of heart disease, stroke, and type 2 diabetes
  - Three or more of the following (or medicated for the following):
    - Large waist circumference
    - High triglycerides
    - Low HDL
    - Increased BP (>130/85)
    - Elevated FBG (>100mg/dL)

**NORMAL METABOLIC CHANGES OF PREGNANCY**

- Adequate maternal weight gain and changes in maternal glucose, protein and fat metabolism
- Important for normal fetal growth & development
- First half of pregnancy (Anabolic)
  - Metabolic state greatly influenced by rising estrogen & progesterone
  - Results in beta-cell hyperplasia, which increases insulin production & tissue sensitivity to insulin
  - Decreased blood sugar
  - Hyper-insulinemic state allows for increased lipogenesis & fat disposition
  - Increased risk for hypoglycemia (as well as N/V)

- Normal pregnancy, fasting blood glucose levels are ~ 10% lower than nonpregnant
- Regarding placental transfer:
  - Glucose (primary fuel used by the fetus) is transported across the placenta through diffusion
  - Insulin does NOT cross the placenta
  - Fetus secretes its own insulin around 18 weeks gestation
  - As mother's glucose rises, so will the fetus' and the fetus will increase its own insulin secretion
NORMAL METABOLIC CHANGES CONTINUED

- Second half of pregnancy (Catabolic)
  - "Accelerated starvation"
  - Rapid switch from carbohydrate to lipid metabolism during fasting as a fuel source for the mother
  - Fat breakdown increases circulation of fatty acids, triglycerides, & ketones
  - Type 1 diabetics increased risk for DKA
  - Increase in hormones leads to insulin resistance and increased hepatic glucose production in mom
  - Glucose sparing mechanism to ensure placenta & fetus have adequate glucose
  - Maternal insulin requirements gradually increase from 18-24 wks to about 36wks gestation (may triple by end of pregnancy)
  - Pregnancy = diabetogenic state of pregnancy-hyperglycemia in the presence of hyperinsulinemia
  - At term: Delivery of placenta prompts abrupt drop in maternal hormones & maternal tissues regain their pre-pregnancy sensitivity to insulin

GESTATIONAL DIABETES

- Glucose or carbohydrate intolerance during pregnancy
- Placental hormones (human placental lactogen) prevent insulin from being used effective → leads to insulin resistance
- GDM – Pancreas is unable to produce sufficient insulin, or the insulin is not used effectively
- Requires treatment to normalize maternal blood glucose levels
- Two types of GDM:
  - GDM A1 – Diet/exercise
  - GDM A2 – Oral agents or insulin needed

GDM RISK FACTORS

- Also high risk:
  - Ethnicity:
    - Hispanic, African American, Alaskan Native, Asian American, Pacific Islander
  - Elevated BP
  - High cholesterol
  - Heart disease
  - PCOS

Figure 1. Risk Categories for GDM

- Low Risk
  - 25 yrs of age
  - No previous history of gestational diabetes
  - Normal weight

- Borderline Risk
  - Some risk factors

- High Risk
  - Diabetes
  - History of first-degree relative
  - Gestational diabetes
  - History of GDM or preeclampsia
  - Previous delivery of infant with macrosomia

GDM diabetes mellitus (GDM gestational diabetes mellitus)
All women screened in 1st trimester and again around 24-28 weeks.

First trimester/prenatal appointment:
- A1C ≥ 5.5% (Pre-Diabetes A1c 5.7-6.4%, Fasting 100-125)
- Fasting ≥ 126 or Random ≥ 200 mg/dL

24-28 weeks screening:
- 75 grams, 2 hour OGTT
- (not recommended before 24 weeks)

Screen at 24-28 weeks

<table>
<thead>
<tr>
<th>Test</th>
<th>IADPSG, ADA, AACE 1-step process</th>
</tr>
</thead>
<tbody>
<tr>
<td>OGTT</td>
<td></td>
</tr>
<tr>
<td>Fasting</td>
<td></td>
</tr>
<tr>
<td>1 hour</td>
<td>100 mg/dL</td>
</tr>
<tr>
<td>2 hour</td>
<td>153 mg/dL</td>
</tr>
</tbody>
</table>

Diagnostic criteria for GDM:
- 1 value equal to or greater than:
  - Fasting 92 mg/dL
  - 1 hour 180 mg/dL
  - 2 hour 153 mg/dL

Screen at first appointment, using FPG and A1C – Include in Prenatal Labs

- A1C < 5.6 or FPG < 91 NML
- 2 hr 75 gm OGTT
  - If one or more values meet or exceed:
    - Fasting 92; 1 hr 180; 2 hr 153
    - A1C 5.7-6.4 or FPG 92-125 mg/dL
    - A1C > 6.5 or FPG > 126

DIAGNOsing DIABETES IN PREGNANCY: ACOG & NIH

- High risk women screened at first prenatal visit (A1C or FPG)
- Screen at 24-28 wks with 1 hour, 50 gm GTT
- If 1 hour GTT glucose > 140 mg/dl, patient returns to do a 3 hour OGTT

1 hour/50 gram GTT ≥ 140 mg/dl

- Diagnostic criteria is 2 values equal to or greater than:
  - Fasting 95 mg/dL
  - 1 hour 140 mg/dL
  - 2 hour 165 mg/dL
  - 3 hour 140 mg/dL
**MANAGING DIABETES**

**BENEFITS OF EXERCISE**
- **REDUCED BLOOD SUGAR**
- **MUSCLES CAN USE GLUCOSE WITHOUT INSULIN WHILE EXERCISING**

**EXERCISE PRECAUTIONS FOR WOMEN TAKING GLUCOSE LOWERING AGENTS**
- Check BG prior to exercise; should be >100mg/dl
- Avoid injecting insulin or taking the oral glucose-lowering medication in the arm or leg that will be exercised within 60-90 minutes of the injection
- Keep glucose meter & fast-acting carbohydrate near
- Hydrate with water before, during, and after exercise
1. 3 meals & 3 snacks, 2-3 hours apart, the same time each day
2. 10 hours should not pass between your bedtime snack & breakfast
3. Drink plenty of fluids. At least six 8-ounce glasses of water or caffeine-free, sugar-free beverages
   Limit coffee to 2 cups daily
4. Artificial sweeteners in moderation
5. Avoid too many carbohydrates at one meal

FOOD GUIDE
Development of this material is supported by Federal Title V funds, received from the California Department of Public Health, Maternal, Child and Adolescent Health Division. © California Department of Public Health

Breakfast Time Total Carbs

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Number Servings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch</td>
<td>1/3 cup</td>
</tr>
<tr>
<td>Fruits</td>
<td>1 cup</td>
</tr>
<tr>
<td>Vegetables</td>
<td>½ cup</td>
</tr>
<tr>
<td>Protein</td>
<td>¼ cup</td>
</tr>
<tr>
<td>Fats</td>
<td>¾ cup</td>
</tr>
</tbody>
</table>

Measure your food, use measuring cups and spoons:
- 1/3 cup
- 1 cup
- ½ cup
- ¼ cup
- ¾ cup

Nutrition Facts

- Carbohydrates- 30-40% of daily intake
- Protein at every meal
- 1800-2500 kcal per day
- Never skip a meal or snack
- Eat foods high in dietary fiber
- Substantial bedtime snack to prevent a severe drop in BG during the night
**Breakfast**

- Insulin resistance is greatest in AM
- Limit carbohydrate to 15 gms
- Include protein
- Avoid cold cereals, bagels, milk, juice, or fruits

**Snacks**

- Protein with 15g of carbohydrate
- In between meals every 2-3 hours

**LUNCH AND DINNER**

- 3-4 oz Protein minimum
- 30-45 grams Carbohydrate
- 2 servings of veggies
- 1-2 servings fat
BEDTIME SNACK

- Most important in preventing elevated fasting
- 15-30g of carbohydrate
- Protein & Fat
- Dawn Phenomenon:
  - Rise in blood sugar in early morning hours (between 3-8am)
  - May be due to growth hormones being released at night that are linked to insulin resistance
  - The liver may produce too much glucose after fasting for too long – thus, bedtime snacks are important

BLOOD GLUCOSE MONITORING

- Step Challenge
- Sanitizing"
PREGNANCY TARGET BLOOD GLUCOSE GOALS:

<table>
<thead>
<tr>
<th>Time</th>
<th>Target Blood Glucose Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting/ pre-meal</td>
<td>95mg/dl or less</td>
</tr>
<tr>
<td>1 hour after meals</td>
<td>140mg/dl or less</td>
</tr>
<tr>
<td>(1 hr after 1st bite)</td>
<td></td>
</tr>
<tr>
<td>2 hours after meals</td>
<td>&lt; 120mg/dl</td>
</tr>
<tr>
<td>ACOG, ADA</td>
<td></td>
</tr>
</tbody>
</table>

Target Blood Glucose levels differ in pregnancy due to the normal diabetogenic state.
TEACHING FOR SELF MANAGEMENT

Dietary & Exercise Management for Pregnant Women with Diabetes

- Follow the prescribed diet plan
- Eat a well balanced diet, including daily food requirements for a normal pregnancy
- Eat a substantial bedtime snack to prevent a severe drop in BG during the night
- Avoid foods high in refined sugar or excessive use of nonnutritive sweeteners
- Never skip a meal or snacks
- Eat foods high in dietary fiber
- Avoid alcohol & nicotine, limit caffeine
- Exercise for 30 minutes most days of the week
  - Walking after meals works best (10-30 minutes)

If target Blood Glucose levels not met with diet & exercise ➔ Medication needed

“SICK DAY MANAGEMENT” OF DIABETES IN PREGNANCY

- Nurses should review guidelines and give written instructions
- Urine ketones should be checked q 4-6 hours and healthcare provider notified of > moderate results
- Blood glucose levels should be checked q 1-2 hours
- Health care provider should be notified of BG >100
- Liquids or soft foods should be consumed equal to the carbohydrate value of the prescribed diet (sugar free for BG >120)
- A sipping diet of 15-30g CHO per hour may be consumed during periods of vomiting
- Call the healthcare provider if liquids are not tolerated
- Report symptoms of ketoacidosis:
  - Abdominal pain, N/V, polyuria, polydipsia, fruity breath, leg cramps, altered mental status, & rapid respirations

COMMON DIABETIC MEDICATIONS USED IN OBSTETRICS

ORAL MEDS & INSULIN
GLYBURIDE (SULFONYLUREA)
- Increases production of insulin & improves insulin sensitivity
- Do not use if allergic to Sulfa
- May cause hypoglycemia
- Dosage 2.5-20mg daily.
  - May be given 1-4 times a day.
  - If given to target postprandial glucose, take 1 hour before the meal.
  - If given to target fasting: take AFTER 1 pm with a snack.
- Studies have shown poorer outcomes in neonates compared to use of insulin (insulin works better to prevent adverse neonatal events).

METFORMIN (BIGUANIDE)
- Inhibits hepatic gluconeogenesis, glucose absorption, & stimulates glucose uptake in peripheral tissues
- Start 500mg nightly for 1 week, then increase to BID (max dose 2500mg daily)
- Does NOT cause hypoglycemia
- Sx's: GI mostly; Nausea, diarrhea but usually subsides within 1-2 weeks
  - Take with food to decrease GI upset
  - Metformin should be discontinued prior to major surgery, or radiological studies involving contrast materials
  - Obtain serum creatinine at start of therapy if renal dysfunction a concern
  - Metformin is cleared in the kidneys
  - Not FDA approved to treat GDM
  - No studies on long term effects to inf. baby
  - Crosses placenta
  - Some studies found increased rate of PTD with use
  - Safe to use postpartum

INSULIN
- Required by 30-60% of women with GDM
- Multiple Daily Injections (MDI); Insulin pump
- Dosing individualized
- May cause hypoglycemia
- Bolus vs Basal MDI:
  - Bolus: Rapid acting insulin controls postprandial & corrections (Lispro/Aspart/Apidra) without increased risk of hypoglycemia
  - Basal: Controls between meal & overnight glucose (NPH, Lantus, Levemir)
- Insulin is the only FDA approved pharmacologic agent shown to reduce fetal morbidity in conjunction with nutrition therapy in women with pre-gestational or gestational diabetes
### INSULIN CHART

<table>
<thead>
<tr>
<th>Type of Insulin</th>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid-acting</td>
<td>Humalog</td>
<td>Lispro</td>
<td>15 minutes</td>
<td>30-90 minutes</td>
<td>3-5 hours</td>
</tr>
<tr>
<td></td>
<td>Novolog</td>
<td>Aspart</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apidra</td>
<td>Glulisine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-acting</td>
<td>Humulin R</td>
<td>Regular (R)</td>
<td>30-40 minutes</td>
<td>3-4 hours</td>
<td>3-8 hours</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Humulin N</td>
<td>NPH (N)</td>
<td>1-2 hours</td>
<td>4-8 hours</td>
<td>10-20 hours</td>
</tr>
<tr>
<td>Long-acting</td>
<td>Lantus</td>
<td>Detemir</td>
<td>1 hour</td>
<td>Peakless</td>
<td>20-26 hours</td>
</tr>
<tr>
<td></td>
<td>Levemir</td>
<td>Glargine</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rapid acting analogs (Lispro and Aspart) & NPH are preferred in pregnancy**

### INSULIN DOSING

<table>
<thead>
<tr>
<th>Weeks of Gestation</th>
<th>Insulin U/kg actual body weight</th>
<th>Type 1* with BMI &gt; 30 , Type 2**, or uncontrolled GDM***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 to 17</td>
<td>0.3 to 0.5</td>
<td>0.7 to 0.8</td>
</tr>
<tr>
<td>Weeks 18 to 24</td>
<td>0.6 to 0.7</td>
<td>0.8 to 1.0</td>
</tr>
<tr>
<td>Weeks 25 to 32</td>
<td>0.8 to 0.9</td>
<td>0.9 to 1.2</td>
</tr>
<tr>
<td>Postpartum</td>
<td>0.3 to 0.5</td>
<td>0.5 to 0.7</td>
</tr>
</tbody>
</table>

http://perinatology.com/calculators/Insulin IMDIO.htm

### INITIATING INSULIN THERAPIES WITH MILD HYPERGLYCEMIA

Table 4. Initiating Insulin Therapies with Mild Hyperglycemia

<table>
<thead>
<tr>
<th>Glycemic Derangement</th>
<th>Suggested Insulin Type and Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent FPG &gt;95 mg/dL, &lt;120 mg/dL</td>
<td>Start 8 - 20 units NPH at bedtime (0.165 or 0.2 units per kg. actual body weight)</td>
</tr>
<tr>
<td>One hour post breakfast plasma value &gt;135 mg/dL, &lt;180 mg/dL</td>
<td>Start 2 - 4 units lispro or aspart pre-breakfast</td>
</tr>
<tr>
<td>One hour post lunch plasma value &gt;135 mg/dL, &lt;180 mg/dL</td>
<td>Add 6-10 units NPH to pre-breakfast injection (And eat lunch 4-5 hrs after breakfast) OR Give 2-4 units lispro or aspart pre-lunch</td>
</tr>
<tr>
<td>One hour post dinner plasma value &gt;135mg/dL, &lt;180mg/dL</td>
<td>Give 2-4 units lispro or aspart pre-lunch</td>
</tr>
</tbody>
</table>

Region 1 California Diabetes and Pregnancy Program insulin treatment guidelines adapted from the International Diabetes Federation and adapted from Region 1 Diabetes guidelines. **Note: Choose one.**
**SUGGESTED PRE-MEAL INSULIN CORRECTION ALGORITHM - MDI**

<table>
<thead>
<tr>
<th>BG before meals (mmol/L)</th>
<th>Before and after meal</th>
<th>Supplement the dose of premeal rapid acting insulin by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70</td>
<td>&lt; 70</td>
<td>2 units less Eat right away, inject insulin after the meal.</td>
</tr>
<tr>
<td>71 - 80</td>
<td>1 unit less</td>
<td>Eat carbohydrate right away.</td>
</tr>
<tr>
<td>81 - 99</td>
<td>1 unit less</td>
<td>Eat right away.</td>
</tr>
<tr>
<td>100 - 129</td>
<td>1 unit more</td>
<td>Eat right away.</td>
</tr>
<tr>
<td>130 - 159</td>
<td>2 units more</td>
<td>Recheck in 15 min, eat when &lt; 110 mg/dL.</td>
</tr>
<tr>
<td>≥ 160</td>
<td>3 units more</td>
<td>Wait 30 minutes to eat if still &gt; 110 mg/dL.*</td>
</tr>
<tr>
<td>≥ 190</td>
<td>4 units more</td>
<td>Check CBG every 30 - 60 minutes, eat when near 110 mg/dL.*</td>
</tr>
</tbody>
</table>

*Although it is best to wait until BG is in a "normal" range to eat, many pregnant women report this to be difficult. In that case, we recommend eating the non-carbohydrate portion of the meal first.

This algorithm should be adjusted to make it effective for the individual. This algorithm uses ~30mg/dL correction above a target of a premeal BG of 100mg/dL. Below 80mg/dL insulin sensitivity may increase, therefore, less than the usual dose should be taken.

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**EDUCATION FOR STARTING INSULIN**

- Glycemic goals for treatment
- Onset, peak, and duration of action of the insulin's being used
- Inspection, storage, & traveling with insulin
- Timing and technique of injections, selecting site & regional rotation-pringle disposal
- Glucagon use & appropriate use by significant other or family
- Prevention strategies & management of hypoglycemia
- Sick-day management
HYPOGLYCEMIA (BG < 70)

- Hypoglycemia = blood sugar less than 70
- Untreated hypoglycemia can lead to decreased LOC, seizures, & death
- Rule of 15:
  - 15 grams of fast acting carbohydrate
  - 4 glucose tablets or gel
  - 5-6 hard candies
  - 4 oz of juice* or non diet soda, 8 oz skim milk
  - Chocolate and Glucerna shakes not advised due to slow-action
- Every 15 minutes until blood glucose is > 70, then eat a meal to stabilize
- If glucose still <70 eat 2-4 additional glucose tablets or gel (or substitutes)
- Wait 15 minutes & recheck if still < 70 → notify health care provider immediately

GLUCAGON EMERGENCY KIT

- IM injection
- Stimulates liver to break down glycogen stored in the liver into glucose
- Can not be given to patients with pheochromocytoma
- Very rare hormone-secreting tumor of the adrenal glands
- All patients with Type 1 DM
- Train the FAMILY
- Nausea & vomiting common side effect
- Turn patient on side
TREATING HYPOGLYCEMIA IN HOSPITALIZED PATIENT WHO IS NPO

- Treating Hypoglycemia for blood glucose > 50 to < 70 mg/dL:
  - Stop insulin infusion
  - Notify physician
  - Check BG every 15 min until >70 mg/dL x 2
  - Restart insulin infusion per algorithm

- BG < 50 mg/dL, & patient is conscious:
  - Increase IV D5 solution to 200 ml/hr until BG > 70
  - BG < 50 mg/dL & patient is unconscious:
  - Also consider 50ml of D50 IV push

- Avoid Glucagon unless the patient is losing consciousness & IV access is lost
  - Glucagon can cause N/V & will block insulin for hours potentially allowing the BG to surge above 200 mg/dL

- FOLLOW YOUR HOSPITAL HYPOGLYCEMIA PROTOCOL!

FETAL AND MATERNAL COMPLICATIONS

- Stillborn *
- Hyperinsulinemia increases O2 demands → hypoxia
- Congenital malformations
- Preterm delivery
- Macrosomia/LGA *
- Cephalopelvic disproportion (CPD)
- Shoulder dystocia *
- Birth trauma (brachial plexus injury, broken humerus or broken clavicle, brain injury)
- Neonatal HYPOglycemia * - follow neonatal blood sugar protocol
- Respiratory Distress Syndrome
- Hyperbilirubinemia/jundice * - unexplained

FETAL COMPLICATIONS
FETAL COMPLICATIONS: MACROSOMIA VS IUGR

- Severe diabetes with vascular changes:
- Utero-placental insufficiency
- Poor placental perfusion
- Leads to IUGR

SHOULDER DYSTOCIA

MATERNAL COMPLICATIONS – INCREASED RISKS:

- Miscarriage (2.5x higher)
- Hypertension during organogenesis leads to SAB or congenital anomalies
- Polyhydramnios
  - Glucose is a diuretic that leads to increased fetal urine output, thus an increase in amniotic fluid
  - PTL, cord prolapse
- Prematurity
  - 9.8% if fasting BG <115
  - 18% if fasting BG >115
  - Prolonged labor & CPD
- Hemorrhage (overdistended uterus)

- Cesarean delivery
- 35% of GDM A1
- 77% of GDM A2
- Infection – endometritis
- Prolonged hospital stays
- Vaginal lacerations
- Anxiety and depression
- Risk of developing Type 2 DM later in life
  - Up to 75% within 22-28 years after delivery
- DKA during pregnancy

Large or small for gestational age at birth — the influences of the intrauterine environment
DIABETIC KETOACIDOSIS
DKA IN PREGNANCY

- Rare complication for women with diabetes (1-3%)
- Serious morbidity & mortality for mother (4-15%) & fetus (9-30%)
- Pregnant women more prone & can occur at BS >200
- Possible preceding events or causes:
  - Infection, illness, trauma, stress response
  - Insufficient or omission of insulin or pump failure
  - Medications that counteract insulin
    - ex. steroids

DKA CLINICAL PRESENTATION

- N/V
- Dehydration
- Fruity odor on breath
- Kussmaul breathing
- Tachycardia
- Hypotension
- Non-reassuring FHR (late decels, minimal/absent variability)
- ECG changes
- Altered LOC

DKA Definition

DKA = 3 letters = triad of DKA

Diabetic
- glucose >200 mg/dl (usually 500-800)

Keto
- ketones produced
- ketones - both in urine and in serum
- Anorexia, nausea, ketone breath/hydration
- Fruity smell, not often encountered in real life
- Consider that if these criteria aren’t met, it may not be DKA

Acidosis
- increased anion gap, metabolic acidosis: HCO₃⁻ <15, pH<7.30
**DKA LABORATORY FINDINGS**

- Elevated glucose levels > 240
- 78–90% of cases occur in 2nd & 3rd trimester with BG <200mg/dL.
- Positive serum/urine ketones
- Arterial pH <7.30
- Anion Gap >12mEq/L
- Elevated base deficit
- Falsely normal K+
- Low serum bicarbonate <15mEq/L
- Elevated serum blood urea nitrogen & creatinine resulting from dehydration/renal failure

---

**TREATMENT OF DKA**

- Hydrate with LR/NS (500–1000ml/h)
- Low dose IV insulin
- Treat cause (infection?)
- Replace K+ as needed
- O2 saturation
- ECG monitoring

*Correct acidosis prior to delivery*

---

**PREVENTION OF DKA**

- Patient education:
  - Never omit insulin
  - Check ketones whenever ill or blood sugar > 200 for more than 4-6 hours
  - Teach patient Sick Day Guidelines
  - Review 5% of ketoadidosis necessary to report
MANAGEMENT AND TIMING OF DELIVERY

- Antepartum testing starting at 34-36wks (as early as 32 weeks if poorly controlled)
- NST/AFI/BPP/Modified BPP
- Studies have not shown increase in stillbirth with well-controlled GDM A1
  - Testing may not be necessary, but often done
  - If well controlled, delivery at 39+0 → 39+6 weeks

LABOR AND DELIVERY CONSIDERATIONS

- Check blood glucose on admission, as needed, as ordered, & after delivery
- Target blood glucose in labor = 70-110mg/dL (optimal 100mg/dL)
- Labor is exercise, so typically blood glucose and insulin requirements will decrease
- First stage Active labor insulin requirements drop by about 1/3 to 1/2
- Pain increases stress hormones & may increase blood glucose
  - Epidural anesthesia & subsequent relaxation reduces catecholamine release which may improve insulin action to lower the blood glucose
- Ephedrine administration may cause an increase in blood glucose for several hours
- Prepare for delivery:
  - Ensure adequate staff and steps taken for potential shoulder dystocia
  - Anticipate newborn care:
    - Assess for neonatal hypoglycemia s/s, cold stress, jittery, etc. (elevated maternal BS levels 18hrs prior to delivery → strongly correlated to neonatal hypoglycemia)
    - Assess for respiratory distress (grunting, retracting, nasal flaring)

LABOR & DELIVERY CONSIDERATIONS

- Rare to require insulin during labor due to increased glucose utilization
  - Particularly for GDM A1 or GDM A2 who is controlled with oral med
- May need insulin infusing if BG > 120 (SQ injections rare in intrapartum setting)
- Discontinue oral agents on day of induction of labor
- If Scheduled Induction of Labor & on Insulin:
  - Usual dose of intermediate acting bedtime insulin given prior to IOL
  - Hold morning dose of insulin
  - Most organizations will require patient's own insulin pump to be turned off during induction and instead be controlled by a continuous insulin infusion via Alaris Pump
  - Follow hospital protocol
**LABOR & DELIVERY (CONT.)**

- If insulin required:
  - Administer per sliding scale hospital protocol – closely follow
  - Hourly finger stick blood glucose monitoring
  - Typically will return to patient’s own insulin pump/SQ injections once patient is eating in postpartum
  - Subcutaneous dose of insulin should be given at least an hour before discontinuing IV insulin

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**CONTINUOUS INTRAVENOUS INSULIN INFUSION (CIII) – DRIP EXAMPLE ONLY**

<table>
<thead>
<tr>
<th>Blood glucose (mg/dL)</th>
<th>INTRAPARTUM</th>
<th>POSTPARTUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units of insulin in ml/hr</td>
<td>Units of Insulin in ml/hr</td>
<td></td>
</tr>
<tr>
<td>70-79 (normal for hypoglycemia)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>80-90</td>
<td>0.5 ml/hr - Start for type 1 diabetes</td>
<td>0</td>
</tr>
<tr>
<td>91-110</td>
<td>1 ml/hr - Start for type 2 diabetes</td>
<td>0.5 ml/hr</td>
</tr>
<tr>
<td>111-130</td>
<td>2 ml/hr</td>
<td>1 ml/hr</td>
</tr>
<tr>
<td>131-150</td>
<td>3 ml/hr</td>
<td>1.5 ml/hr</td>
</tr>
<tr>
<td>151-170</td>
<td>4 ml/hr</td>
<td>2 ml/hr</td>
</tr>
<tr>
<td>171-190</td>
<td>5 ml/hr</td>
<td>2.5 ml/hr</td>
</tr>
<tr>
<td>&gt;190</td>
<td>Assess urine for ketones, Call MD for insulin dose</td>
<td></td>
</tr>
</tbody>
</table>

Begin IV fluids as follows: BG > 130: LR @ 125/h; BG < 130 D5 1/2 NS or D5/LR @ 100 - 125/h

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*Example only! Follow own hospital policy.*
POSTPARTUM – FIRST 24 HOURS

- Many GDM A1 patients may resume a regular diet per order.
- Many GDM A2 controlled with oral meds will no longer need oral meds, or dosages will decrease substantially.
- Type 1 and 2 and GDM A2 on Insulin: Insulin requirements will decrease substantially.
  - Approximately ½ to ¾ of final pregnancy dose.
- Type 1 diabetics usually require 50-60% of pregnancy dose (if eating a full diet).
- If C/S, may need continuous IV infusion of glucose & insulin until they resume a regular diet.
- Follow own hospital policy.
Breastfeeding

- **Mom:**
  - Breastfeeding will lower blood sugar levels
  - Hypoglycemia risk so ensure adequate eating and hydration
- **Infant:**
  - Breastfeeding within 1st 30min of life decreases hypoglycemia in infant
  - Breastfeeding reduces infant risk of obesity & developing impaired glucose tolerance
  - Longer duration of breastfeeding reduces incidence of type 2 diabetes

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**POSTPARTUM FOLLOW-UP**

**Pre-existing Diabetes**
- Follow weekly for 6 weeks
- Return to PCP or Endo every 3-6 months
- Family planning
- Pre-conception care
- Recommend A1c < 6.5 prior to conception

**GDM**
- Postpartum: 75g 2 hr GTT
  - Includes a fasting
- Annual screening for diabetes
- Early screening in future pregnancies

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The End!
REFERENCES

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