Special Populations: Preconception and Pregnancy

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Diabetes in Pregnancy

Diabetes is one of the most commonly encountered complications of pregnancy
- >150,000 pregnancies annually
- Congenital malformations are most notable complication
  - ~40%-50% of perinatal deaths
  - Associated with maternal hyperglycemia and the consequent fetal hyperinsulinemia


Definition of Diabetes in Pregnancy

2 groups
- Women with pre-existing diabetes (diabetes prior to conception)
  - ~0.2%-0.3% type 1
  - ~65% type 2
  - ~2% undiagnosed type 2
- Gestational diabetes (GDM) (onset during pregnancy)
  - ~7% of pregnancies

Pregnancy with pre-existing diabetes

(diabetes prior to conception)

Perinatal Complications

- Complications are related to the level of maternal glycemia

- Complications in the First-Trimester:
  - Congenital malformations (~ 6%–13%)
    - Cardiovascular, CNS, Skeletal
  - Spontaneous abortions (~ 30%–60%)

- These complications often occur before a woman knows she is pregnant


Perinatal complications

- Macrosomia
  - Abnormally large body size
  - ~ 20-32% of pregnancies with diabetes

- Still birth

- Respiratory distress syndrome (RDS)

- Hypocalcemia, Hyperbilirubinemia, polycythemia

Maternal Complications

- Hypertension
  - Pregnancy induced
  - Preeclampsia
  - Chronic hypertension
- Hydramnios
  - Excess amniotic fluid
  - Possibly due to increased fetal urine production
- Infectious postoperative complication
- Preterm delivery
  - Related to mother’s blood pressure status
- Cesarean section

Normal Metabolism

Early gestation:

- The fetus depends on the mother for an uninterrupted supply of fuel or nutrition

Increases occurs in:

- Tissue glycogen storage
- Peripheral glucose utilization
- Hepatic glucose production

Late Gestation:

- ↑ growth of fetus
- ↑ hormones levels
  - Lactogen
  - Estrogen
- ↑ insulin resistance
- ↓ in food may result in ↑ in free fatty acids and ketones
  - ↑ risk of DKA


First Trimester of Pregnancy with Preexisting Diabetes

- Hormone changes can result in erratic blood glucose levels
- Meal plans should be adjusted to accommodate BG changes
- Critical to avoid ketonemia and ketoacidosis

Second and Third Trimesters of Pregnancy with Preexisting Diabetes

- Energy requirements will increase
- Insulin resistance will start to increase
  - Especially in second half of pregnancy
- Insulin requirements will increase
  - ↑ dosages of rapid or short-acting insulin (bolus insulin) needed to cover meals
  - ↑ dosages of intermediate or long-acting insulin (basal insulin) needed to maintain nocturnal insulin levels
  - ↑ risk of DKA in the third trimester

Treatment of Diabetes in Pregnancy

- **NonPharmacological**
  - DSME education
  - Including preconception counseling and care
  - Exercise/Activity
  - Medical Nutrition Therapy
  - SMBG
  - Weight management

- **Pharmacological**
  - Insulin
Patient Education Outline for Pregnancy with Preexisting Diabetes

- Preconception Counseling
- Patient education for pregnancy
- Postpartum education

Preconception Counseling and Care

- Begins 3 to 6 months prior to conception and continues throughout pregnancy
  - Normalize and stabilize blood glucose levels
  - Optimize diabetes control
- Counseling for:
  - Women with preexisting diabetes
    - Type 1
    - Type 2
  - Women at risk for type 2 diabetes

Preconception Counseling and Care: Prior to Discontinuing Contraception

- Assessment of complications
  - Microvascular
  - Macrovascular
- Discontinue oral antidiabetic agents (if applicable)
- Nutrition assessment and modifications
  - Modify meal plans to meet anticipated pregnancy needs
  - Calcium, iron, folic acid assessment and supplementation

Homko CJ, Sargrad KR. A Core Curriculum for Diabetes Educators; 2003:107-110
Preconception Counseling and Care: Prior to Discontinuing Contraception

- Self-Management skill assessment
  - Review SMBG technique
  - Review insulin administration technique
  - Review hypoglycemia prevention, awareness and treatment skills
  - Review glucagon emergency plan
- Continue contraception until glucose goals are attained

Homko CJ, Sargsrad KR. A Core Curriculum for Diabetes Educators; 2003:107-110

Medical Nutrition in Pregnancy

- Adequate nutrition is one of the most important influences on the health of pregnant women and their infants.

Recommended Dietary Allowances (RDA) in Pregnancy

- **Protein**
  - 0.8 g/kg/day during 1st half of pregnancy
  - Same as non-pregnant women
  - 1.1 g/kg/day during 2nd half of pregnancy
  - Add 50 g/day for twins

- **Carbohydrate (CHO)**
  - Same as preconception intake
  - Minimum of 175 g/day to assure fuel for CNS for fetus and mother
  - Use insulin-to-CHO ratios for appropriate insulin doses
    - usually larger at breakfast since CHO is less well tolerated due to increase in cortisol and growth hormones.

Institute of medicine of the National Academies. Dietary Reference Intakes; 2002
Meal Plans in Pregnancy

- Eat meals at regular times
  - Small, frequent meals and snacks
    - every 2 to 4 hours
  - Minimize hypoglycemia

- Bedtime snacks
  - Decreases risk of nocturnal starvation, ketonuria and ketonemia

- Match insulin to food consumption

- Check BG levels often

Recommended Ranges of Total Weight Gain for Pregnant Women

- **BMI < 19.8** (underweight) 28–40 lb
- **BMI 19.8 – 26.0** (normal weight) 25–35 lb
- **BMI 26.0 – 29.0** (overweight) 15–25 lb
- **BMI > 29** (obese) ~15 lb

Recommended Ranges of Total Weight Gain for Pregnant Women (cont.)

- **Twin Gestation** 35–45 lb
- **Triplet Gestation** 45–55 lb

Blood Glucose Goals in Diabetic Pregnancy (Preconception)

- Pre-meal: 80–110 mg/dl
- 2–hour postprandial: <155 mg/dl

Preconception care of women with diabetes. Diabetes Care. 2003;26:S91-93

Blood Glucose Goals in Diabetic Pregnancy

- Fasting: 65–100 mg/dl
- Pre-meal: 65–115 mg/dl
- 1 hour postprandial: <145 mg/dl
- 2 hour postprandial: <135 mg/dl
- 2-6 hour postprandial: 65–135 mg/dl

Preconception care of women with diabetes. Diabetes Care. 2003;26:S91-93
Monitoring

- Ketones
  - Whenever BG > 200 mg/dl
  - During illness (result of nausea/vomiting)
    - Urine
      - First morning urine
    - Blood
      - Daily
- A1C
- Blood Pressure

Insulin During Pregnancy

- Insulin regimen should be individualized
  - May require 3 to 4 injections or more daily
  - Rapid or short acting at meals (bolus)
  - Intermediate or long acting at bedtime (basal)

Pre-meal Regular/ Bedtime NPH (Bolus/Basal)
Continuous Subcutaneous Insulin Infusion (CSII)

- Insulin pump therapy
  - Lowers the amount of basal insulin
  - ↓ risk of premeal hypoglycemia
  - ↑ control over postprandial glucose excursions

- Ideally started prior to conception, however, can be started at any point
  - Especially if suboptimal glucose control


Insulin Requirements Throughout Gestation

<table>
<thead>
<tr>
<th>Period</th>
<th>Units/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconception</td>
<td>0.6</td>
</tr>
<tr>
<td>First Trimester</td>
<td>0.7</td>
</tr>
<tr>
<td>Second Trimester</td>
<td>0.8</td>
</tr>
<tr>
<td>Third Trimester</td>
<td>0.9-1.0</td>
</tr>
<tr>
<td>Postpartum</td>
<td>&lt;0.6</td>
</tr>
</tbody>
</table>

- Women > 150% of ideal body weight ↑ 1.5-2.0 units/kg
  - Insulin resistance due to obesity


Insulin Requirements Throughout Gestation

- Adjustments may be necessary in first trimester due to ↑ incidence of hypoglycemia
  - Most common during sleep
  - Women with history of severe hypo events at greater risk

- Family education on hypoglycemia
  - Prevention
  - Awareness
  - Treatment
    - Glucagon administration

Labor and Delivery

- Goals of diabetes care during labor:
  - Adequate CHO intake
  - Glucose administer via continuous IV
    - ~ 2.0–2.5 mg/kg/minute
  - Maintain normal BG levels
    - Measured every 1–2 hours
    - Short-acting insulin
      - Multiple subcutaneous dosing
      - CSII

Postpartum

- Immediate ↓ insulin requirements
  - Little to no insulin may be required in the first 24–48 hours post delivery
  - ~ 0.6 units/kg for non-lactating women
  - ~ 0.4 units/kg for lactating women
    - (based on current weight)
  - Support and education
    - Balance of mother’s self-care needs with infant needs
    - Assessment for postpartum depression
    - ↑ risk of hypoglycemia
    - Education on prevention, awareness and treatment
    - Modification of meal plans

Lactation

- Breastfeeding mothers need less insulin
  - ↑ expended calories
  - May need CHO snack before/during nursing
  - Increase in hypoglycemia
  - Oral agents are not approved for use during lactation
    - Insulin can be used
Key Take Home Points

- Preconception care planning is essential
- Diabetes care and blood glucose control need to be optimal at least 3–6 months prior to conception.
  - Contraception use should be emphasized until blood glucose goals have been attained

Key Take Home Points

- Diabetes care and glucose control need to be monitored very closely during pregnancy
- Treatment plans should be reviewed regularly for necessary adjustments
- Education and monitoring in the postpartum period.

Gestational Diabetes Mellitus (GDM)

(onset during pregnancy)
Gestational diabetes

- CHO intolerance with onset or first recognition during pregnancy
  - Includes women with undiagnosed type 2 diabetes prior to pregnancy but are diagnosed during pregnancy
  - Includes women using medications or that have medical conditions that affect glucose tolerance.

Biastre SA, Slocum J. A Core Curriculum for Diabetes Educators; 2003:145-146

Metabolic Changes

- Similar to the second and third trimesters of pregnancy with pre-existing diabetes
  - ↑ mobilization of glucose
  - ↓ insulin sensitivity
  - ↑ circulating hormones
  - ↑ basal insulin requirements
  - ↑ risk ketones (urine & blood)

Biastre SA, Slocum J. A Core Curriculum for Diabetes Educators; 2003:145-146

Perinatal complications

- Similar to complications in pregnancy with preexisting diabetes
  - Macrosomia
    - Abnormally large body size
    - ~ 20-32% of pregnancies with diabetes
  - Stillbirth
  - Respiratory distress syndrome (RDS)
  - Hypocalcemia, Hyperbilirubinemia, polycythemia

Long–Term Complications of GDM
- ↑ risk of developing GDM in future pregnancies
  - ~ 30-50%
- ↑ risk of developing type 2 diabetes
- ↑ risk of obesity in offspring
- ↑ risk for offspring to develop intellectual and neurological conditions

Metzger BE et al. Diabetes Care. 1998;21

Diagnosis of GDM
- Risk assessment at first prenatal visit

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>High Risk</th>
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</thead>
<tbody>
<tr>
<td>&lt; 25 years of age</td>
<td>Obesity</td>
</tr>
<tr>
<td>Normal weight prior to pregnancy</td>
<td>History of GDM</td>
</tr>
<tr>
<td>No family history of diabetes</td>
<td>Family history of diabetes</td>
</tr>
<tr>
<td>No history of glucose intolerance</td>
<td>Glycosuria</td>
</tr>
<tr>
<td>Ethnicity of low risk</td>
<td>Ethnicity of high risk</td>
</tr>
</tbody>
</table>

Diagnosis of GDM
- Women at low to average risk screened between weeks 24–28 of gestation
- Women at high risk should be screened as early as possible

Diagnosis of GDM

Screening test (step 1)
- 50 g oral glucose load (random)
- Plasma glucose level > 130 mg/dl
- 1 hour postprandial
- Proceed to OGTT step 2

Diagnosis of GDM

Diagnosis criteria (step 2)
- 100 g glucose load after overnight fast of no less than 8 hours and no more than 14 hours
- 3-hour test
  - Fasting: 95 mg/dl
  - 1 hour: 180 mg/dl
  - 2 hour: 155 mg/dl
  - 3 hour: 140 mg/dl
- 2 or more exceed limit: GDM diagnosis

Management of GDM

Non-Pharmacological
- DSME Education
- Exercise/Activity
- Medical Nutrition Therapy
- SMBG
- Weight Management

Pharmacological
- Insulin
Medical Nutrition Therapy for GDM

- Primary treatment
- CHO controlled meal plans
  - Control of BG levels
- Appropriate weight gain
  - Avoid maternal ketosis
- Meal plans to deliver appropriate nutrients
  - ↓ hypoglycemia, nausea, vomiting

MNT and SMBG

- SMBG can assist in making appropriate food adjusts in the meal plan
  - CHO affects postprandial BG levels
  - Minimum of 175 g/day to assure fuel for CNS for fetus and mother
  - Monitor fasting, preprandial, 1– and/or 2–hour postprandial and bedtime BG levels

GDM Blood Glucose Goals

- Fasting < 105 mg/dl
- 1 hour postprandial < 155 mg/dl
- 2 hour postprandial < 130 mg/dl
Exercise and Activity

Activity

- Can improve glucose intolerance
- Should be encouraged
- Best BG lowering effect observed with 1 hour of activity
- Obtain medical clearance before starting an exercise program during pregnancy
  - Avoid with HTN, preterm labor history, persistent bleeding


Insulin Therapy

- Only Human insulin used in GDM
  - ↓ risk of transplacental transport of anti-insulin antibodies
- Start if BG goals not achieved
  - ~ 20%-25% of women with GDM require insulin therapy
  - ↓ risk macrosomia

Insulin Therapy

- Insulin regimens should be individualized
  - ↑ insulin needs thru progression of pregnancy
  - Adjust dosage accordingly to BG levels
  - Obese patients may need large amounts of insulin

- Starting dose:
  - Standardized
  - Based on body weight


Oral Antidiabetic Agents in GDM

- Currently NOT recommended during pregnancy
- No oral anti-diabetic agents are approved by the FDA for treatment of GDM

Postpartum Care

- Normal glucose tolerance returns usually after delivery
- Women with history of GDM should be screened for type 2 diabetes regularly
- Preconception planning should be emphasized for subsequent pregnancies
- Contraception choices reviewed
- Nutrition and activity

Metzger BE et al. Diabetes Care. 1998;21
Key Take Home Points

- Women at high risk should be screened and tested for GDM early
- Diabetes care and glucose control need to be monitored very closely during pregnancy
  - Medical Nutrition Therapy should be the primary and continual treatment.
  - Treatment plans should be reviewed regularly for necessary adjustments
- Education and monitoring in the postpartum period

What Questions Can I Answer for You???