GESTATIONAL DIABETES

MATERNAL CHILD HEALTH
WEB BASED MODULE SERIES
OUTLINE

- Definitions of diabetic conditions in pregnancy
- Diagnosis and screening
- Medical management
- Insulin dosing
- Antenatal testing
- Intrapartum concerns
- Postpartum concerns
- Question review
WHY DO WE CARE?

- Prevalence depends of definition, but on the rise
  - 5-18% in US in recent years
- GDM is the single most common medical complication of pregnancy
- GDM can/should be managed by family doctors
# Definitions of Diabetes in Pregnancy

- **Current classification:** gestational vs pre-gestational
- **Historical:** White’s Classification

## Table: Definitions of Diabetes in Pregnancy

<table>
<thead>
<tr>
<th>Class</th>
<th>Onset</th>
<th>Fasting Gluc</th>
<th>2-hr Post Gluc</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Gestational</td>
<td>&lt;105</td>
<td>&lt;120</td>
<td>Diet</td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td>&gt;105</td>
<td>&gt;120</td>
<td>Medication</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class</th>
<th>Age at onset</th>
<th>Duration (yrs)</th>
<th>Vascular dz?</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>&gt;20</td>
<td>&lt;10</td>
<td>None</td>
<td>Insulin</td>
</tr>
<tr>
<td>C</td>
<td>10-19</td>
<td>10-19</td>
<td>None</td>
<td>Insulin</td>
</tr>
<tr>
<td>D</td>
<td>&lt;10</td>
<td>&gt;20</td>
<td>None</td>
<td>Insulin</td>
</tr>
<tr>
<td>F</td>
<td>Any</td>
<td>Any</td>
<td>Nephropathy</td>
<td>Insulin</td>
</tr>
<tr>
<td>R</td>
<td>Any</td>
<td>Any</td>
<td>Retinopathy</td>
<td>Insulin</td>
</tr>
<tr>
<td>H</td>
<td>Any</td>
<td>Any</td>
<td>Heart</td>
<td>Insulin</td>
</tr>
</tbody>
</table>

40 years of research - No consensus

USPSTF 2008 still insufficient evidence for or against screening

International Association of Diabetes and Pregnancy Study Group (IADPSG) 2010 Recommendations

- One step approach
- Prevalence estimate up to 18% in US
- Endorsed by ADA also (but not ACOG)
- Screen ALL women at first prenatal visit with a fasting plasma glucose
  - If $\geq 92$ mg/dl but $<126$ mg/dl $\Rightarrow$ GDM is diagnosed
- Women with normal initial testing should have 2 hr GTT at 24-28 weeks (GDM= 1 or more abnormal)
  - Fasting $\geq 92$ mg/dl, 1 hr $\geq 180$ mg/dl, 2hr $\geq 153$ mg/dl

American College of Obstetricians and Gynecologists (ACOG) Committee Opinion (2011)³

- Prevalence estimate 5-9% in US
- 2 step testing
- First screen with 1 hr GTT
  - At first visit with risk factors
  - At 24-28 weeks without risk factors
  - A value of ≥130 mg/dl is abnormal
- Then move on to 3 hr GTT: diagnosis is 2 or more abnormal
  - Fasting ≥95 mg/dl
  - 1 hr ≥180 mg/dl
  - 2 hr ≥155 mg/dl
  - 3 hr ≥140 mg/dl
- If only 1 value is abnormal, patients can be re-screened, but no consensus guideline on this

RISK FACTORS

- Maternal factors
  - Obesity
  - Personal hx of glucose intolerance
  - Family hx of GDM or type 2 DM
  - Polycystic ovaries
  - Age >25 years
  - Chronic steroid use
  - Hispanic, Native American, African American or Pacific Island ethnicity

- Obstetric factors
  - Twin gestation
  - Hx of infant >9lbs
  - Hx of shoulder dystocia
  - Unexplained perinatal loss
PREGNANCY PHYSIOLOGY

- Pregnancy is already a diabetogenic state
  - Increased Human Placental Lactogen (HPL), which binds to insulin receptor
  - Increase in free Cortisol, causing insulin resistance
- Insulin resistance is the net effect in maternal tissue

- Glucose crosses the placenta, but not insulin
  - Net effect is hyperglycemia in the infant \(\Rightarrow\) increased IGF-1
  - IGF-1 is responsible for growth in the fetus

**EVIDENCE FOR TREATMENT**

- **Blood sugar goals** - 4 checks 4x a day
  - Fasting <95mg/ml
  - 2 hours postprandial <120mg/ml
    - Ideally <110

- **Evidence for treatment**
  - Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study
  - Showed linear relationship between increasing glycemia and adverse outcomes
    - Birth weight
    - Need for first time c-section
    - Fetal c-peptide levels
    - Neonatal hypoglycemia

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Evidence for treatment

- Australian Carbohydrate Intolerance Study in Pregnant Women
  - Women randomized to treatment or no treatment
  - Primary outcomes: fetal death, shoulder dystocia, fetal nerve palsy, fetal fracture, induction of labor, cesarean delivery
  - Treatment group- fewer perinatal complications
  - Control group- more inductions
  - Same number of c-sections

Optimal timing and goals for glycemic control are unknown

DIETARY MANAGEMENT

- Refer to nutrition!

- Diet must adequately meet the needs of pregnancy but restrict carbohydrates to 35% to 40% of daily calories

- For women with a body mass index >30, restrict calories to 25 kcal/kg actual weight per day¹

- Regular moderate exercise can improve glycemic control but is not proven to change outcomes¹

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Medical therapy recommended when goals are not being met:\n
- **ACOG**
  - Fasting >95 mg/dl
  - 1 hr postprandial >130-140 mg/dl
  - 2 hr postprandial >120 mg/dl

- **ADA**
  - Fasting >90-99 mg/dl
  - 1 hr postprandial >140 mg/dl
  - 2 hr postprandial >120-127 mg/dl

At MHRI we will use goal of >20% abnormal for stepping up therapy:

- Provider dependent, and you may decide to treat with fewer abnormal values
- Tight control is ideal
MEDICATION MANAGEMENT

- Insulin is usually first line
- Guided by expert opinion only as there are no RCT’s
- Hospitalization for very uncontrolled diabetics

- One regimen: 0.7 units/kg/day based on pre-pregnancy weight
  - Divide 2/3 of total for morning and 1/3 for evening
  - Divide morning dose into 1/3 short acting and 2/3 long acting
  - Divide evening dose into ½ short acting and ½ long acting

- Another method: Start at 20-30 units of long acting insulin once a day

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7. ACOG Practice Bulletin, Gestational Diabetes Mellitus. Number 30, September 2001
What type of insulin to use?

- Most studies used NPH and short acting insulin
- There is a small amount of evidence for aspart and lispro over regular in GDM
- Aspart and lispro still FDA category B, not endorsed officially by ACOG and ADA
- Long-acting Lantus (insulin glargine) is FDA category C
  - Insufficient data regarding crossing the placenta
  - Concern for up-regulation of IGF-1 and macrosomia
  - May be continued in women with preexisting diabetes who are well controlled but is not currently recommended for newly diagnosed GDM

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Oral hypoglycemics are not endorsed by ACOG or the ADA, but could be considered for women who cannot comply with insulin treatment

**Glyburide**

- Several trials indicate is *likely* safe and effective
- Not enough evidence/patient volume to prove
- Disagreement about crossing the placenta
- Begin at 2.5 mg qd and titrate up to a maximum of 20 mg qd (10 mg bid). Increase dose as needed by 2.5 to 5 mg/wk

**Metformin**

- Does cross the placenta
- Is often less effective than glyburide or insulin

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7. ACOG Practice Bulletin, Gestational Diabetes Mellitus. Number 30, September 2001
ADA recommends screening for congenital anomalies for women who were likely hyperglycemic during organogenesis\(^4,7\):
- A1C >7% or fasting glucose >120 mg/dL at diagnosis of GDM
- Diagnosis of GDM in first trimester

ACOG recommends testing for women with poorly controlled GDM\(^4,7\):
- Typically twice-weekly NST/AFI, depends on local practices
- Fetal weight by growth ultrasounds not been shown to be superior to physical exam

No RCTs on this subject

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7. ACOG Practice Bulletin, Gestational Diabetes Mellitus. Number 30, September 2001
ACOG Consensus on GDM 2001

- If A1 and well controlled “there is no good evidence to support routine delivery before 40 weeks of gestation”
- If A2, not well controlled, hypertensive, or with history of stillbirth treat as pre-existing diabetes (delivery by 39 weeks)
- If inducing prior to 39 weeks in a non-emergent situation, fetal lung maturity should be checked by amniocentesis
- C-section should be offered at an EFW of >4500g in GDM

7. ACOG Practice Bulletin, Gestational Diabetes Mellitus. Number 30, September 2001
Women who are diet controlled do not usually need monitoring.

If on oral hypoglycemics, discontinue in labor or 12 hr before a scheduled induction.

Monitor glucose hourly while in labor.

Goal is normoglycemia (80 to 110 mg/dl) using insulin and D5 lactated Ringer’s IV fluid historically.

Many women on insulin will achieve control with ½ of their normal dose of intermediate acting insulin given before labor.

Consideration of risk of shoulder dystocia and macrosomia at all times.

Medication and insulin are typically not needed postpartum.

At MHRI we typically check a fasting glucose prior to discharge.

- Typically a 2 hr GTT is performed at 6 weeks postpartum.

- 50% will develop DM in the following 5-10 years.
  - Counseling on weight loss, diet, exercise.
  - Regular screening as part of well-woman care.

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## NEONATAL MANAGEMENT

**Table 1**

<table>
<thead>
<tr>
<th>Time</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prenatal</strong></td>
<td>Ultrasound for size and anomalies</td>
</tr>
<tr>
<td></td>
<td>Biophysical profile</td>
</tr>
<tr>
<td></td>
<td>Maternal hemoglobin $A_{1c}$</td>
</tr>
<tr>
<td></td>
<td>Physical examination for:</td>
</tr>
<tr>
<td></td>
<td>Congenital anomalies</td>
</tr>
<tr>
<td></td>
<td>Size for dates</td>
</tr>
<tr>
<td></td>
<td>Respiratory distress</td>
</tr>
<tr>
<td><strong>Delivery room</strong></td>
<td></td>
</tr>
<tr>
<td>Evaluation at postnatal age (h)</td>
<td>0.5, 1, 1.5, 2, 4, 8, 12, 24, 36, 48</td>
</tr>
<tr>
<td>Serum glucose</td>
<td>6, 24, 48</td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>Check if calcium low</td>
</tr>
<tr>
<td>Hgb/Hct</td>
<td>4, 24</td>
</tr>
<tr>
<td>Platelet count</td>
<td>24</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>Based on clinical jaundice</td>
</tr>
<tr>
<td>Ferritin</td>
<td>24</td>
</tr>
</tbody>
</table>

These guidelines represent initial, minimal assessments. Abnormal parameters must be followed more closely.

NEONATAL MANAGEMENT

- **Initial management at MHRI**
  - 30, 60, 90 minute gluceses for all LGA babies or infants born to diabetic mothers

- **Long term data now coming out**\(^{10}\)
  - More likely to develop diabetes later in life
  - Increased risk for motor and cognitive delays
    - Related to birth asphyxia, birth injury, glucose status, iron status, etc.

SUMMARY

- GDM is a common and significant problem
- Many ways to define it, becoming more conservative as we are seeing more poor outcomes
- No evidence on how to manage medically, when or how to time delivery
- Neonatal outcomes can be significant
- Family doctors can successfully manage both mom and baby
The current ACOG recommended screening test for GDM is:

a) 100 g of glucose, test is fasting
b) 50 g of glucose, test is non fasting
c) 50 g of glucose, test is fasting
d) 100 g of glucose, test is non fasting
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b) 50 g of glucose, test is non fasting
c) 50 g of glucose, test is fasting
d) 100 g of glucose, test is non fasting

The current recommendation by ACOG is to screen with two-step testing at 24-28 weeks with a 1 hour glucose load (50 grams, non-fasting) and move on to 3 hour glucose load if this is positive (>130 mg/dl)
The current IADPSG guidelines for screening at the initial visit are:

a) Fasting plasma glucose
b) 75 g of glucose, test is fasting
c) Hemoglobin A1c
d) 100 g of glucose, test is fasting
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a) **Fasting plasma glucose**
b) 75 g of glucose, test is fasting
c) Hemoglobin A1c
d) 100 g of glucose, test is fasting

The current IADPSG guidelines state to screen ALL women at first prenatal visit with a fasting plasma glucose. If this testing is normal, all women should have a 2 hour GTT at 24-28 weeks (fasting, 75g glucose).
What are the target values for capillary blood glucose (CBG) testing by the patient?

a) Fasting < 95; post-prandial < 140
b) Fasting < 105; post-prandial < 120
c) Fasting < 95; post-prandial < 120
d) Fasting < 105; post-prandial < 140
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b) Fasting < 105; post-prandial < 120  
c) Fasting < 95; post-prandial < 120  
d) Fasting < 105; post-prandial < 140

These are the current target glucose values we routinely use at MHRI and are endorsed by ACOG.
If monitoring is necessary, the key components of the third trimester management of uncontrolled GDM are:

a) NST/AFI 2x weekly, BPP weekly, ultrasound monthly for EFW
b) NST/AFI 2x weekly, +/- growth ultrasound if macrosomia suspected by physical exam
c) NST/AFI every other week, monthly u/s for EFW, fetal kick counts
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c) NST/AFI every other week, monthly u/s for EFW, fetal kick counts

The guidelines for monitoring are all based on expert opinion, but this is what many practitioners do.
ACOG recommends C-section for EFW over 4000g.

a) True
b) False
ACOG recommends C-section for EFW over 4000g.

a) True
b) False

ACOG recommends offering a c-section to women with GDM who had an EFW >4500g or women without GDM who have an EFW >5000g.
A well controlled Class A1 Gestational diabetic can safely deliver at 40 weeks gestation and beyond.

a) True
b) False
A well controlled Class A1 Gestational diabetic can safely deliver at 40 weeks gestation and beyond.

a) True  
b) False

The recommendations by ACOG are that there is no evidence to deliver before 40 weeks in a well controlled GDM A1 woman. If someone is A2 or not well controlled, delivery is recommended by 39 weeks.
Capillary blood glucose (CBG) should be checked during labor in a patient on insulin:

a) If the patient is symptomatic
b) Hourly
c) Every 2-3 hours
d) According to the provider’s practice style
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a) If the patient is symptomatic
b) Hourly
c) Every 2-3 hours
d) According to the provider’s practice style

If a patient is on insulin, the current policy is to check CBG’s hourly. If they are diet controlled or on oral medications checking may be less frequent.
Appropriate post-partum testing of the patient with GDM includes:

a) Fasting CBG daily while inpatient and a fasting glucose at 6 weeks postpartum
b) Fasting CBG PPD #1 plus a hemoglobin A1c at 6 weeks postpartum
c) Fasting glucose once while inpatient and 2 hr GTT at around 6 weeks post partum
d) It is not necessary to screen after delivery
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c) Fasting glucose once while inpatient and 2 hr GTT at around 6 weeks post partum
d) It is not necessary to screen after delivery

The current ACOG recommendation is to screen all women who had GDM with a fasting glucose while inpatient and a 2 hour GTT at the 6 week postpartum visit.
Appropriate initial management of an infant of a diabetic mother includes:

a) A blood glucose 1 hour after the first feeding
b) Blood glucoses at 30, 60, and 90 minutes of life, and more testing as needed
c) Immediate weight to assess for macrosomia
d) Calcium and hemoglobin measurement universally
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Infants born to diabetic mothers should have glucoses measured as above and additional testing if they are symptomatic.