Gestational Diabetes
Definition:

• Carbohydrate intolerance with onset or recognition during pregnancy

  – Women with GDM are unable to compensate for the insulin resistance of pregnancy, which is produced by a combination of hormonal and inflammatory changes
White Classification

• Class A₁: gestational diabetes; diet controlled
• Class A₂: gestational diabetes; medication controlled
• Class B: onset at age 20 or older or with duration of less than 10 years
• Class C: onset at age 10-19 or duration of 10–19 years
• Class D: onset before age 10 or duration greater than 20 years
• Class E: overt diabetes mellitus with calcified pelvic vessels
• Class F: diabetic nephropathy
• Class R: proliferative retinopathy
• Class RF: retinopathy and nephropathy
• Class H: cardiac artery disease
• Class T: prior kidney transplant
Prevalance

• The prevalence varies in direct proportion to the prevalence of DMII in a population or ethnic group
• 6-7% of pregnancies are complicated by DM, 90% of these cases are GDM
• Increased prevalence in Native American, Latina, Asian, and Pacific Islander women
• As the general population becomes more obese, the prevalence of GDM becomes increased
Why Do We Care?

• Fetal Complications
  – Macrosomia
  – Hypoglycemia
  – Hyperbilirubinemia
  – Shoulder dystocia
  – Operative delivery

• Maternal Complications
  – Gestational HTN
  – Preeclampsia
  – Cesarean section
  – DM II later in life
HAPO (Hyperglycemia and Adverse Outcomes)

• Intl multicenter study to observe how mild hyperglycemia can adversely affect maternal and fetal outcomes during pregnancy
• Participants completed 75g 2hr GTT btw 24 6/7-32wks
• They were not incl if they had a ‘overt DM,’ fasting >105 and/or 2hr >200
HAPO cntd

• Four primary outcomes:
  – birth weight above the 90th percentile for gestational age
  – primary cesarean delivery
  – clinical neonatal hypoglycemia
  – cord-blood serum C-peptide level above the 90th percentile (fetal hyperinsulinemia)

• Secondary outcomes:
  • premature delivery (before 37 weeks of gestation)
  • shoulder dystocia or birth injury
  • need for intensive neonatal care
  • hyperbilirubinemia
  • preeclampsia
Figure 1. Frequency of Primary Outcomes across the Glucose Categories.
HAPO Secondary Outcomes

- Twelve of the 15 analyses of secondary outcomes showed significant positive associations with maternal glycemia, after adjustment for confounders.
- The strongest associations were found for preeclampsia.
- Shoulder dystocia and birth also showed increased odds ratio associated with an increase in maternal hyperglycemia.
- Premature delivery, intensive neonatal care, and hyperbilirubinemia were associated with higher 1 & 2 hour glucose levels but not with higher fasting levels.
Screening: Who?

- Everyone!!!

Screening: When?

- At the onset of prenatal care
- At 24-28wk EGA
Screening: How?

- At the onset of PNC
  - HgbA1c
  - Fasting glucose
- At 24-28wks EGA
  - 1hr GTT (50g glucose) then 3hr GTT (100g glucose)
  - 2hr GTT (75g glucose)
What is better? 2step v 1step

• Intl Assn of Diabetes and Pregnancy Grp recommends universal 2hr GTT which would dx 18% of women w/GDM, incr the prevalence of GDM significantly; however, there is no evidence that the therapeutic interventions needed to tx these women would decr adverse outcomes but would incr costs
Two step 1hr then 3hr Official Rec

• In 2013 the Eunice Kennedy Shriver National Institute of Child Health and Human Development Consensus Development Conference on diagnosing GDM recommended 1hr then 3hr approach stating that there is no evidence that 2hr would improve clinical outcomes but would increase health care cost
1hr GTT 130 v 140

• No ideal measure
• 140 could create fewer false positives and improved positive predicted values; however, the sensitivity goes from 90% to 100% when 130 is used instead of 140
• Cutoff of 135 is most commonly used
Two Sets of Criteria for 3hr GTT for diagnosis

# Table 1. Proposed Diagnostic Criteria for Gestational Diabetes Mellitus

<table>
<thead>
<tr>
<th>Status</th>
<th>Plasma or Serum Glucose Level Carpenter and Coustan Conversion</th>
<th>Plasma Level National Diabetes Data Group Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg/dL mmol/L</td>
<td>mg/dL mmol/L</td>
</tr>
<tr>
<td>Fasting</td>
<td>95 5.3</td>
<td>105 5.8</td>
</tr>
<tr>
<td>One hour</td>
<td>180 10.0</td>
<td>190 10.6</td>
</tr>
<tr>
<td>Two hours</td>
<td>155 8.6</td>
<td>165 9.2</td>
</tr>
<tr>
<td>Three hours</td>
<td>140 7.8</td>
<td>145 8.0</td>
</tr>
</tbody>
</table>

• In one study of 26,000 women, the Coustan and Carpenter dx 50% more women
• ACOG recommends that individual physicians use the criteria that is best for their community taking into account their communal resources and ethnic makeup of their patient population
Why Treat?
Bc of these two studies!

• The Australian Carbohydrate Intolerance Study in Pregnant Women 2005

• *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Maternal- Fetal Medicine Units (NICHD MFMU) Network
The Australian Carbohydrate Intolerance Study in Pregnant Women

• multicenter, 10-year, randomized treatment trial that included 1,000 women conducted at 14 sites in Australia

• Designed to see if tx of mild GDM would improve perinatal complications
The Australian Carbohydrate Intolerance Study in Pregnant Women

• Treatment was associated with reduction in the primary outcome: composite of serious complications
  – Perinatal death
  – Shoulder dystocia
  – Birth trauma incl fx and nerve palsy

• Treatment also reduced
  – Frequency of LGA infants (22% → 13%)
  – BW > 4000g (21% → 10%)

• Treatment also reduced maternal outcomes
  – Preeclampsia (18% → 12%)
2009 Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal–Fetal Medicine Network randomized, multicenter treatment trial of 958 women with mild GDM to determine if intervention perinatal morbidity and obstetric complications
• Demonstrated no difference in frequency of composite primary outcome
  – Perinatal death
  – Neonatal hypoglycemia
  – Elevated umbilical cord C peptide level
  – Birth Trauma
2009 Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal–Fetal Medicine Network

• Demonstrated differences in secondary outcomes for infants
  - Lower frequency in LGA infants
  - Lower frequency in BW >4000g
  - Reduced neonatal fat mass

• Demonstrated differences in maternal outcomes of
  - Cesarean delivery
  - Shoulder dystocia
  - Hypertensive disorders
Why Treat?

Based on these studies, it is felt that women in whom GDM is diagnosed should be treated with nutrition therapy and, when necessary, medication for both fetal and maternal benefit.
Nutrition

• ADA recommends nutrition counseling for all patients
• GDM diet should consist of
  – 40% CHO
  – 40% fat
  – 20% prot
Nutrition

• Complex CHO better than simple CHO
• Three meals and two to three snacks are recommended to distribute glucose intake and to reduce postprandial glucose fluctuations
### TABLE 1 NEW RECOMMENDATIONS FOR TOTAL AND RATE OF WEIGHT GAIN DURING PREGNANCY, BY PREPREGNANCY BMI

<table>
<thead>
<tr>
<th>Prepregnancy BMI</th>
<th>BMI+ (kg/m²) (WHO)</th>
<th>Total Weight Gain Range (lbs)</th>
<th>Rates of Weight Gain* 2nd and 3rd Trimester (Mean Range in lbs/wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>28–40</td>
<td>1 (1–1.3)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5–24.9</td>
<td>25–35</td>
<td>1 (0.8–1)</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0–29.9</td>
<td>15–25</td>
<td>0.6 (0.5–0.7)</td>
</tr>
<tr>
<td>Obese (includes all classes)</td>
<td>≥30.0</td>
<td>11–20</td>
<td>0.5 (0.4–0.6)</td>
</tr>
</tbody>
</table>

+ To calculate BMI go to [www.nhlbisupport.com/bmi/](http://www.nhlbisupport.com/bmi/)
* Calculations assume a 0.5–2 kg (1.1–4.4 lbs) weight gain in the first trimester (based on Siega-Riz et al., 1994; Abrams et al., 1995; Carmichael et al., 1997)
What about Exercise?

• Studies exploring relationship btw exercise and GDM are few and limited in power, but overall, it is felt that exercise increased insulin sensitivity

• BUT it is recommended that patients w/GDM esp obese and overweight patients, do moderate exercise (ex walk for 30min after eating)

• Walking or doing exercise may lower PP CBGs and avoid transition to PO meds and/or insulin
DM Education

• Call Diane Clokey
  – 505-272-6933
  – Leave msg incl
    • Pt’s name
    • Pt’s MRN
    • Pt’s primary language
How to treat?

• Women should check CBG
  – Fasting (goal \( \leq 95 \))
  – 1-2hr postprandial (goal \( \leq 120 \))

• Why postprandial?
  – Postprandial CBG are more predictive of better glycemic control, lower rates of LGA infants, and lower rates of cesarean delivery
Sidebar: Prescribing Pitfalls

• When prescribing glucometer, test strips, and lancets, include dx and number of times the pt needs to check her CBGs
  – E-scribe incl in special instructions
  – Printed scripts in order comments
    • Dx: GDM, pt must check CBG 4x/day
• Otherwise delay in pt receiving her glucometer, etc
Medication

• The goals for CBGs are based on data that pertains to increased perinatal morbidity when such values are exceeded in women with pre-existing diabetes
• These therapeutic targets were chosen to alleviate the risk for fetal macrosomia
• It is felt that approx 25% of women w/GDM require medication
In general, to start insulin use 0.7-1 units/kg

- 50% NPH qHS
- 50% short acting before meals (lispro or aspart) divided btw meals

OR

- 30% short acting before each meal
- 10% NPH qHS
Wait, what about PO meds?

- PO meds have come into their own in last 10yrs
- PO agents have improved compliance, cost, and convenience
- No studies on long term effects of PO meds on children of GDM
- Glyburide
- Metformin
Glyburide

• second-generation sulfonylurea that binds to pancreatic B-cell receptors to increase insulin secretion as well as increasing peripheral insulin sensitivity
• Dose: 2.5-20mg daily
• Cannot use in first trimester
• Demonstrated similar control of hyperglycemia and similar outcomes w/neonatal hypoglycemia and macrosomia, but some concerns for higher fasting glucose and higher birth weight (both not statistically significant)
Metformin

• biguanide that acts to inhibit hepatic gluconeogenesis as well as to stimulate glucose uptake in peripheral tissues

• no differences in perinatal outcomes as reflected in a composite of perinatal morbidity (neonatal hypoglycemia, respiratory distress, need for phototherapy, birth trauma, and pre-maturity)

• Dose: 500-2000mg daily

• 46% of users had to transition to insulin
Antenatal Testing

- GDMA1- no
- GDMA2- yes
  - NST 2x/wk
  - AFI 2x/wk
  - Growth U/S 29, 33, 37wks

- DMI or II
  - NST 2x/wk
  - AFI 2x/wk
  - Growth U/S q4wks starting at 24wks
  - Fetal echo/genetic level U/S at 18-20wk
When to Deliver?

• Most studies suggest that with good glycemic control, delivery should be at 39wks
• In a cohort multiple time series study, IOL at 38–39 wks EGW for women with insulin-treated GDM was compared expectantly managed historic controls (this data has not been confirmed by other studies)
  – No significant difference in macrosomia or cesarean delivery rates
  – 10% increase in shoulder dystocia in women >40wks
IOL v LTCS

• All women w/GDM & DM should have an U/S done at 35-37wks to assess growth and identify macrosomonia

• If the EFW is >4500g, then the woman should be counseled on the risk of birth trauma and offered LTCS
Post Delivery: Can she stop the diet?

• Although glucose intolerance usually resolves, post delivery, up to ½ of women develop preDM or DM when followed for 28yrs

• More recent study demonstrated that approx 10% of women w/GDM developed DM by 10yrs v 1% of non GDM
  - 1/3 of women will have preDM or DM 6-12wks after delivery
  - There is a seven fold increase in DMII in women w/prior hx of GDM compared w/women who did not have GDM
Fig. 1. Management of postpartum screening results.

Abbreviations: FPG, fasting plasma glucose; OGTT, oral glucose tolerance test; IGT, impaired glucose tolerance.

Postpartum Screening

- the Fifth International Workshop on Gestational Diabetes Mellitus recommended that women with GDM undergo a 75-g, 2-hour OGTT at 6–12 weeks postpartum
  - May also use fasting glucose is easier but lacks dx of impaired glucose tolerance
  - May also use HgbA1c at 12wks
Postpartum...It doesn’t stop w/pregnancy

- ADA recs that women w/GDM cont to receive nutrition/healthy lifestyle modification education
- Use meds if needed to tx glucose intolerance→metformin
Common Problems

• Lets brainstorm
  – What to do if pt isn’t sticking to diet?
  – What to do if pt isn’t checking her sugars
  – What to do if pt is restricting herself too much?
  – Other pitfalls

SPEAK UP ➔ WE LEARN FROM EACH OTHER
References

• ACOG Practice Bulletin, “Gestational Diabetes Mellitus” Number 137, August 2013