In-Hospital Care of Women with Diabetes During Pregnancy

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Things to know…
- Type of diabetes
- What was her Glycemic control like
- Frequent Blood Glucose checks are key
- Labor is Exercise
- All insulins or oral hypoglycemic meds are NOT the same
- Delivery increases insulin sensitivity
- Breastfeeding increases insulin sensitivity
- Diabetes complications
- Long-term potential issues

Goals (1)
- Outcomes match those of normal, non-diabetic women with respect to:
  - Intrauterine growth patterns
  - Birth defects
  - Mortality and morbidity
- Normal labor and delivery
- Breastfeeding
- Reduce Short- and Long-term outcomes for women and their offspring
Insulin Dependent or Type 1 (1,2,13,14)
- Absolute insulin deficiency
- Usually Genetic
- Autoimmune –pancreatic B-cells
- Triggers may include viruses or toxins
- Must have exogenous insulin
- Prone to ketoacidosis with hyperglycemia and hypoglycemia

Type 2 (non-insulin dependent) or Gestational Diabetes (1,2,14)
- Relative insulin deficiency
- Mechanisms are unclear
  - defects in insulin binding to receptor
  - defects in post-receptor events, such as glucose transport
- ↑ insulin secretion
- Ineffective in lowering blood glucose
- Beta cells “exhaust” over time
- Insulin secretion decreases

Perinatal Screening
Diabetes or Suspected Pre-existing
Diabetes (1,18)

Refer mother for:

- Blood pressure
- Dilated retinal exam
- Urine for Microalbumin/protein
- Serum Creatinine
- Dental exam- if client has not had dental care in last 6 months
- Other exams as clinically indicated

First trimester
• Fetal exams
  ▪ Ultrasound for dates and document pregnancy
  ▪ Evaluate glycemic control with HgbA1c

Diabetes or Suspected Pre-existing
Diabetes or Utilizing Medications (1,18)

Second Trimester Fetal Exams

- Expanded Serum Alpha Fetoprotein at 15-20 weeks
- Level 2 Ultrasound (Anatomy Scan) at 18-20 weeks
- Fetal echocardiogram at 20 to < 24 weeks
- Evaluate glycemic control with HgbA1

Diabetes or Suspected Pre-existing
Diabetes or Utilizing Medications (1,18)

Third Trimester Maternal/Fetal Exams

- HgbA1
- Kick Counts - starting at 26-30 weeks
- Ultrasound
  - Follow growth at 28 weeks
  - for estimated fetal weight (~37 wks)
- Amniocentesis if planned delivery before 38 1/2 wks
- Non-stress test (NST) or Bio-Physical Profile (BPP) as early as 26 weeks with complications
  - NST or BPP at 32-34 wks if utilizing meds or poor movement OR
  - NO meds and good movement - no NST or BPP until 40 wks
- Ammonic fluid index (AFI) or Bio-physical Profile as indicated
Gestational Diabetes WITHOUT Medications

Third trimester
- Kick counts 26-30 weeks
- Non-stress check with complications as early as 26 weeks
- With no complications begin at 40 wks
- Glycemic control evaluated
- Ultrasound for estimated fetal weight and for delivery planning
- Amniocentesis if planned delivery before 38 1/2 weeks or with poor dating or poor blood glucose control
- Recommended delivery by 41 weeks

IN-HOSPITAL CARE OF THE WOMAN WITH DIABETES DURING HER PREGNANCY

Antepartum
- Poor glycemic control
  - Keep Blood Glucose controlled
  - Meal plan and CHO Control
  - Diabetic Ketoacidosis
  - Hyperemesis
  - Infections - Pyelonephritis
  - Preterm labor - Birth
  - Abnormal fetal growth
  - HTN- PIH or Preeclampsia
  - Progression of Complications (pregestational)
Poor Glucose Control --- Look For:

- Pregnancy
- Illness/Infection
- Steroids - added or increased
- Other medications that ↑ glucose
- Stress
- Not taking medications for Hyperglycemia
- Food
- Depression
- Other-- Vacation...

Blood Glucose Targets

<table>
<thead>
<tr>
<th>Time</th>
<th>Plasma Glucose mg/dl California (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting and pre-meal</td>
<td>65 - &lt;90</td>
</tr>
<tr>
<td>Post-meal 1 hour</td>
<td>100 - &lt;130</td>
</tr>
<tr>
<td>Post-meal 2 hour</td>
<td>&lt;120</td>
</tr>
<tr>
<td>2-6AM</td>
<td>65-120</td>
</tr>
<tr>
<td>Interpartum</td>
<td>70-110</td>
</tr>
</tbody>
</table>

Insulin Requirement During Pregnancy (118)

- Triple Insulin
- Double Insulin
- Normal Insulin

Weeks: Conception 0 5 10 15 20 25 30 35 40  Delivery

GDM or DM 2 Type 1
Basic Blood Glucose Control

- 3 Meals and 3 Snacks
- Control total carbohydrate
  - Basic CHO distribution 15-30/15-30/15-30
  - Target 175 + grams of CHO per day
- Control fasting, pre and post meal blood glucose
- Minimum testing is FBS and post meals at 1 hour
- Begin medications if greater than 20% of blood gluoses are out of range and can’t change activity or meal plan

Diabetic Ketoacidosis (DKA)

- Is a Medical Emergency
- Can occur with blood gluoses as low as 180 mg/dl
- Generally associated with type 1
- Biochemical Triad of:
  - Causes are Hyperglycemia
  - Ketonemia
  - Acidemia
- Find the CAUSE

Diabetic Ketoacidosis - 1/3 fetal loss due to hypoxia or acidosis

- Monitor ketones, BG, K+, CO2 (metabolic panels) and Fetus
- Neuro signs and cardiac telemetry
  - Can Cause cereberal edema and confusion
  - Can Cause Cardiac arrythmias
- Check BG hourly and Metabolic panel Q2 hours- you want BG to fall approximately 100-150 mg/dl/hr
Antepartum
Preterm Labor and Delivery (12%) (12, 15)

- Tocolysis with β-sympathomimetic cause a rapid increase in maternal glucose and possible DKA
  - Least effect on BG with magsulfate and indomethacin and nifedipine
  - Largest BG effect with terbutaline

Betamethasone (15)
Within 4 hours of first dose...

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3 and 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double insulin dose (as needed)</td>
<td>Continue modified dose-doubled (as needed)</td>
<td>Give 150% of usual insulin dose</td>
<td>Revert to pre-steroid dose (usual insulin dose)</td>
</tr>
</tbody>
</table>

Hypertension, PIH and Preeclampsia (7, 11, CMQCC Preeclampsia toolkit 2013)

- HTN - Increased incidence with DM including GDM (double non-DM) (7, 11)
- PIH - Development of HTN during latter half of pregnancy
- Preeclampsia - up to as high as 14% with poorer BG control (14% with DM vs 7% without DM)
- Higher with pre-existing Hypertension or Nephropathy
- PCOS expected 21% +
Chronic HTN With Superimposed Preeclampsia

Differential Diagnosis
- Blood Pressure (130+ SBP or 90+ DBP)
- Rapidly worsening HTN > 20 weeks gestation usually preeclampsia
- Headache, visual complaints
- Proteinuria
  - Development of proteinuria > 20 weeks GA
  - Development of proteinuria when there was none originally
- Laboratory Tests Uric Acid Levels, AST, ALT, and Platelet Count

*If Preeclampsia Dx see CMQCC Preeclampsia toolkit

Intrapartum

- Early Labor
- Active Labor
- Postpartum

Delivery Plan
- Based on size of baby
- Maternal complications
- Timing of delivery and plans
- Fetal complications and maturity
- BG control
- OB history
Glucose mediated pregnancy outcomes for women with diabetes

| Birth defects | Diabetic (%): 9 + | Nondiabetic (%): 1-3 |
| Macrosomia/LGA | 20 –30 % | <12 % |
| Cesarean Birth | 30 – 50 % | 15 –25 % |
| Newborn Hypoglycemia | up to 50% | Rare after initial 2-3 hours of life |
| Future risk for obesity, CVD, HTN-offspring | Increased |

Be Prepared for…

- Macrosomia
- Shoulder Dystocia
- Emergency Cesarean
  - Availability of OB, Anesthesia?
  - Neonatology/Pediatrics
  - ? Fetal Anomalies?
  - Other Newborn complications

Glycemic control is related to outcomes

- DM rate of macrosomia = 26% Vs. 10% normal
- Macrosomia = body > head
- US for EFW>36 weeks
  - >4500 = Cesarean
  - >4000 to <4500
    - Is body (shoulder circumference) > head?
      - yes = cesarean recommended
      - no = trial of labor
When woman arrives at Labor and Delivery…
What is her capillary blood glucose (CBG) now? And…
- Her overall control?
- What does it mean in relationship to….
  - When and what was her last meal?
  - Any insulin/meds she may have taken
  - When did she take her last medications
  - The targets for blood glucose in labor?

Presenting to Labor and Delivery
Unit --Interpartum
- Check BG on admission and K+
  - Find out what kind of meter you or your client is using
  - Last meal the last medications were taken
  - Blood glucose target is 100-<130 mg/dl 1 hour after meal or 65-<90 mg/dl fasting
  - If active labor aim is for 70-110 mg/dl plasma or 60-100 mg/dl
- Check urine and/or blood ketones
- If presenting with a complication - address complication

Insulin in labor by glucose control and Type of diabetes
Gestational Diabetes Diet controlled it is very unlikely that this women would require an insulin drip
- Blood glucose testing is every 2-3 hours
- If 110 mg/dl or above treat with insulin drip
- Or reduce D5W or D5NS
GDM - Medication or Type 2
- Blood glucose every 2-3 hours unless above 110 mg/dl
- At 110 start an insulin drip or reduce D5
Type 1 - start insulin drip if above 70 mg/dl
- Adjust insulin drip per algorithm
- Adjust D5 per algorithm
Presenting in LABOR and DELIVERY

- Type of Diabetes
- Planned?
- Known Complications
- Blood Glucose on admission (if using clients meter check against lab)
- Target BG is 70-110 mg/dl
- Assess content and timing of last meal and insulin/medication
- Begin IV of ringers or NS for main line
- In active labor - place NPO (ice chips+) and secondary IV with Dextrose (D5)

Gestational Diabetes - Diet controlled

- Place NPO (ice chips+)
- No insulin infusion required (so IV is optional)
- Monitor capillary BG every 2-3 hours

*If she becomes insulin controlled during labor → treat same as women with Type 2 diabetes

Carbohydrate prescription:

Deliver 5-10 grams CHO/hour during labor to maintain Blood Glucose (6-9,18)

- If >110
  - Non caloric (non-CHO) clears
- If <110
  - 15 gms CHO (equivalent to 4 ounces juice) q 3 hours
  - IV D5 @ 100-125/hr (5 gms glucose per hour)
Insulin drip

- Blood glucose every hour and as needed
  - Notify MD for BG above 180-190 mg/dl
- Dip urine for Ketones every 4 hours or each void - notify MD if small (moderate) or greater
- Insulin is mixed in a 1:1 ratio and
  - Inserted in to port closest to IV insertion
- D5 125-200 ml hour
- I and O
- Fetal monitoring
- Target blood glucose 70-110 mg/dl - proceed per policy

Sample Algorithm - Type 2 Diabetes or GDM

<table>
<thead>
<tr>
<th>Blood Glucose</th>
<th>Insulin Dose</th>
<th>Drip ml/hr</th>
<th>Fluid</th>
<th>Adjusted Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;70</td>
<td>0</td>
<td>0</td>
<td>125-200 ml D5</td>
<td>No insulin</td>
</tr>
<tr>
<td>71-110</td>
<td>0</td>
<td>0</td>
<td>100 D5</td>
<td>No insulin</td>
</tr>
<tr>
<td>111-130</td>
<td>1</td>
<td>1</td>
<td>Reduced D5</td>
<td>Start insulin drip</td>
</tr>
<tr>
<td>131-160</td>
<td>2</td>
<td>2</td>
<td>No D5</td>
<td>Adjust insulin up</td>
</tr>
<tr>
<td>161-190</td>
<td>3</td>
<td>3</td>
<td>No D5</td>
<td>Adjust insulin up</td>
</tr>
</tbody>
</table>

Sample Algorithm – Type 1 Diabetes

<table>
<thead>
<tr>
<th>Blood Glucose</th>
<th>Insulin Dose</th>
<th>Drip ml/hr</th>
<th>Fluid</th>
<th>Adjusted Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;70</td>
<td>0</td>
<td>0</td>
<td>125-200 ml D5</td>
<td>No insulin</td>
</tr>
<tr>
<td>71-110</td>
<td>0.5</td>
<td>0.5</td>
<td>100 D5</td>
<td>No insulin</td>
</tr>
<tr>
<td>111-130</td>
<td>1</td>
<td>1</td>
<td>Reduced D5</td>
<td>Start insulin drip</td>
</tr>
<tr>
<td>131-160</td>
<td>1.5</td>
<td>1.5</td>
<td>No D5</td>
<td>Adjust insulin up</td>
</tr>
<tr>
<td>161-190</td>
<td>2</td>
<td>2</td>
<td>No D5</td>
<td>Adjust insulin up</td>
</tr>
</tbody>
</table>
Hypoglycemia - GDM or Type 2 (1,6-9)
- Once active labor in progress → D5 at 100-200 ml/hr
- **Under 110 mg/dl**
  - Stop insulin infusion if started or increase D5 at 125 - 150 ml/hr mg/dl
  - BG 71-109 mg/dl
    - D5 at 125 - 200 ml/hr
  - Usually treat **70 mg/dl or lower**
    - Start or increase D5 at 125 - 150 ml/hr mg/dl
  - ≤ 50 mg/dl then increase to 200 ml/hr
    - Or 25 ml D50 IV push x1 and repeat per MD order
  - Check BG **every 15 minutes** until > 70 mg/dl x 2
  - Glucagon 1mg/cc may be utilized if IV access lost - IM or SQ

Hypoglycemia - Type 1 (1,6-9)
- Once active labor in progress D5 at 100-200 ml/hr unless...
- **Usually treat 70 mg/dl or lower**
  - Stop insulin infusion
  - Start or increase D5 at 125 - 150 ml/hr mg/dl
  - **Under < 50 mg/dl** then increase to **200 ml/hr**
    - Or 25 ml D50 IV push x1 and repeat per MD order
  - Check BG every 15 minutes until > 70 mg/dl x 2
  - Glucagon 1mg/cc may be utilized if IV access lost - IM or SQ
  - Adjust insulin drip when restarted

Factors that increase the risk of hypoglycemia in the hospital
- Lack of clear communication and/or coordination between dietary, transportation, and nursing staff
- Lack of sufficient frequency in CBG monitoring
- Failure to recognize changes in insulin requirements due to renal failure, liver disease, change in clinical status, steroid use or interruption/changes in feeding or insulin
**Adjusting Insulin Drip**

- If client remains above targets after 2 hours and fluid adjustment - then increase algorithm by 0.5 units per hr
- Repeat every 2 hours until BGs remains within 70-110 mg/dl
- If client requires treatment for <70 mg/dl decrease algorithm by 0.5 units per hour - when turning drip back on

**Induction - why?**

- Prevent fetal demise (RR is 3.1 Schmidt, DC, 2001)
- Prevent excessive fetal growth
  - Shoulder dystocia (RR is 1.8 Cammu, AJOG, 2002)
  - Erbs palsy
  - Fractured clavicle
- For IUGR
- Poor glucose control
- Avoid cesarean delivery
- Control of medications and timing of delivery

**Induction of Labor**

- Fetal body composition and weight distribution
  - Babies continue to grow in utero
  - If poor glycemic control the baby may grow at an accelerated rate
- Incorporation of Estimated Fetal Weight in deciding route of delivery
- Labor management- epidural, timing, …
- Cervical ripeness
  - Increased incidence of C/S if the induction is for guesstimated macrosomia (31% Kjos, 1993)
For an Induction

- Begin in AM
- Client takes usual insulin or glyburide the night before
- In AM hold insulin or glyburide - may receive a modified dose of insulin
- Correct blood glucose with insulin drip or dextrose as needed
- Once active labor begins may need to give Dextrose at 100-125ml/hr

Cesarean Section

- Normal dose of insulin or pills the night before
- No insulin or pills in AM of Cesarean
- Schedule early if possible
- Check BG before surgery
- Correct BG to between 70-110 mg/dl with IV insulin before cesarean section

![Insulin Requirements During Pregnancy](image)
Early Postpartum

- Cut algorithm in half (Type 1 and some Type 2)
- D/C IV insulin after delivery of the placenta with GDM and/or Type 2
- Aim of therapy is to keep blood glucose in the following range:
  - FBG < 100 - 110;
  - One hour post-meal < 150 – 160
- Breastfeed every hour for first 4 hours
- Poor glycemic control will negatively affect healing and breast-feeding

Blood Glucose Control with Breastfeeding and Diabetes (Type 1 or Type 2)

<table>
<thead>
<tr>
<th>Breastfeeding</th>
<th>Not Breastfeeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting/Premeal</td>
<td>70-100 mg/dl</td>
</tr>
<tr>
<td>1-2 hours postmeal</td>
<td>120-155 mg/dl</td>
</tr>
<tr>
<td>Check Blood Glucose 3-7 times per day and anytime hypoglycemia is suspected</td>
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</tr>
<tr>
<td>Aim for A1c &lt; 6.5 at 3 months</td>
<td>Aim for A1c &lt; 7 at 3 months</td>
</tr>
</tbody>
</table>

In-Hospital...

GDM TESTING in Hospital

- BG testing FBS (≤92 mg/dl) and 2-3 times after approximately 3 meals (≤153 at 2hrs postprandial)
  - If BG above target refer and treat if appropriate, before 6 week follow up test (may not require 75 Gm OGTT)

If Normal in Hospital...

- Client should follow up with 75 Gram, 2 hour OGTT 5 + weeks or more postpartum
- Or A1c after 3 month (12 weeks) and beyond
References

17. ADA. Diagnosis and classification of diabetes Mellitus. Diabetes Care 2010;33(Suppl 1):s82–s89.
18. SSEP. Guidelines-at-a-glance for pre-existing diabetes in pregnancy. 2014

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What did you Say?? What did you Mean? WHY?