

# DIABETES IN PREGNANCY: DIAGNOSIS AND MANAGEMENT

---

Lisa E. Moore, MD,MS, FACOG, RDMS

Texas Tech Health Sciences Center

Division of Maternal-Fetal Medicine

# OBJECTIVES

- To review current trends in the diagnosis and management of gestational diabetes
  - To understand current controversies in the diagnosis and management of gestational diabetes.
  - To review the use of insulin and oral agents in gestational diabetes.
-

# HOW BIG IS THE PROBLEM?



## Statistics About Diabetes Data from the National Diabetes Statistics Report, 2014 (released June 10, 2014)

In 2012, 29.1 million Americans, or 9.3% of the population, had diabetes.

Of the 29.1 million, 8.1 million were undiagnosed –

In 2012, 86 million Americans age 20 and older had prediabetes

Diabetes remains the 7th leading cause of death in the United States in 2010,

- The rates of diagnosed diabetes by race/ethnic background are:
  - 7.6% of non-Hispanic whites
  - 9.0% of Asian Americans
  - 12.8% of Hispanics
  - 13.2% of non-Hispanic blacks
  - 15.9% of American Indians/Alaskan Natives
-

# INCIDENCE OF DIABETES IN PREGNANCY

- Incidence in all pregnancies in the US: 5-14%
- Canada 8-18%
- China 7-10%
- India – possibly as high as 27%
  
- 80% of patients with diabetes complicating pregnancy have gestational diabetes
  
- 10-20% of patients with diabetes complicating pregnancy have pre-existing diabetes (Type 1 and Type 2)

# GESTATIONAL DIABETES (DEFINITION)

- Carbohydrate intolerance that begins or is first recognized during pregnancy
  - Diagnostic Categories: GDM A1 and A2
  - 15% of GDM remain diabetic (Type 2)
  - 50-60% of GDM will become diabetic in 5-10 yrs
-

# TYPE 2 DIABETES

- Encompasses insulin resistance and relative insulin deficiency.
  - Associated with obesity – or increased percentage of body fat.
  - May go undiagnosed for many years
-



# BOTH GDM AND TYPE 2 ARE HETEROGENEOUS DISORDERS

- Pathophysiology is characterized by
    - peripheral insulin resistance
    - impaired regulation of hepatic glucose production
    - decreased insulin production
  - \* Today both clinical entities are viewed as the same disease with different names
-

# PRE-DIABETES

- In 2010 the ADA committee on diagnosis and classification recognized an intermediate group
- Blood glucose not high enough to have diabetes but also not normal.
- IFG (impaired fasting glucose) fasting 100mg/dl – 125 mg/dl
- IGT (impaired glucose tolerance) 2 hr value on the OGTT of 140mg/dl – 199 mg/dl

# PRE-DIABETES

- This is considered an intermediate stage
  - IFG and IGT are not diseases in their own right but are risk factors for diabetes and cardiovascular disease.
-

## HGB A1C

- A1C of 5.5-6.0% have a 5 year cumulative incidence of diabetes from 12% to 25%
  - NHANES data indicate that A1C of 5.5 -6.0% identifies people with IFG and IGT.
-

## HGB A1C


- Compared to a fasting glucose of 100 mg/dl – using A1C 5.7% or above is 66% sensitive and 88% specific for the development of diabetes in 6 years.
- Individuals with A1C 5.7-6.4 should be informed of the risk and receive counseling regarding changes in lifestyle

.

# CATEGORIES OF INCREASED RISK

- Fasting 100mg/dl – 125 mg/dl
- 2h values on the 75gOGTT 140mg/dl-199 mg/dl
- A1C of 5.7-6.4

# WHY DO WE CARE ABOUT DIABETES IN PREGNANCY?



*So wait...why do we have to learn this again?*

# ADVERSE EFFECTS IN OFFSPRING

- Conception to 8<sup>th</sup> week
- Malformations:
  - Caudal regression (3wk)
  - NTD (4 wk)
  - Cardiac (5 wks)
  - Renal (5 wks)
  - GI (6 wks)
- 8<sup>th</sup> week to delivery
  - Chronic hypoxia
  - Intrauterine death
  - Hyperinsulinism
  - Macrosomia
  - Organomegaly
  - Polyhydramnios



# BIRTH DEFECTS

- Most important FACTOR: glycemic control during embryogenesis
- If Gestational diabetes begins after first trimester;no increase in birth defects
- In women with pre-existing diabetes:8.5% increase in cardiac defects,5.3% in CNS defects,and 3.5% in GI and GU defects
- HGA1c levels prior to embryogenesis determine the risks for birth defects. A1c greater than 7 increase the risks

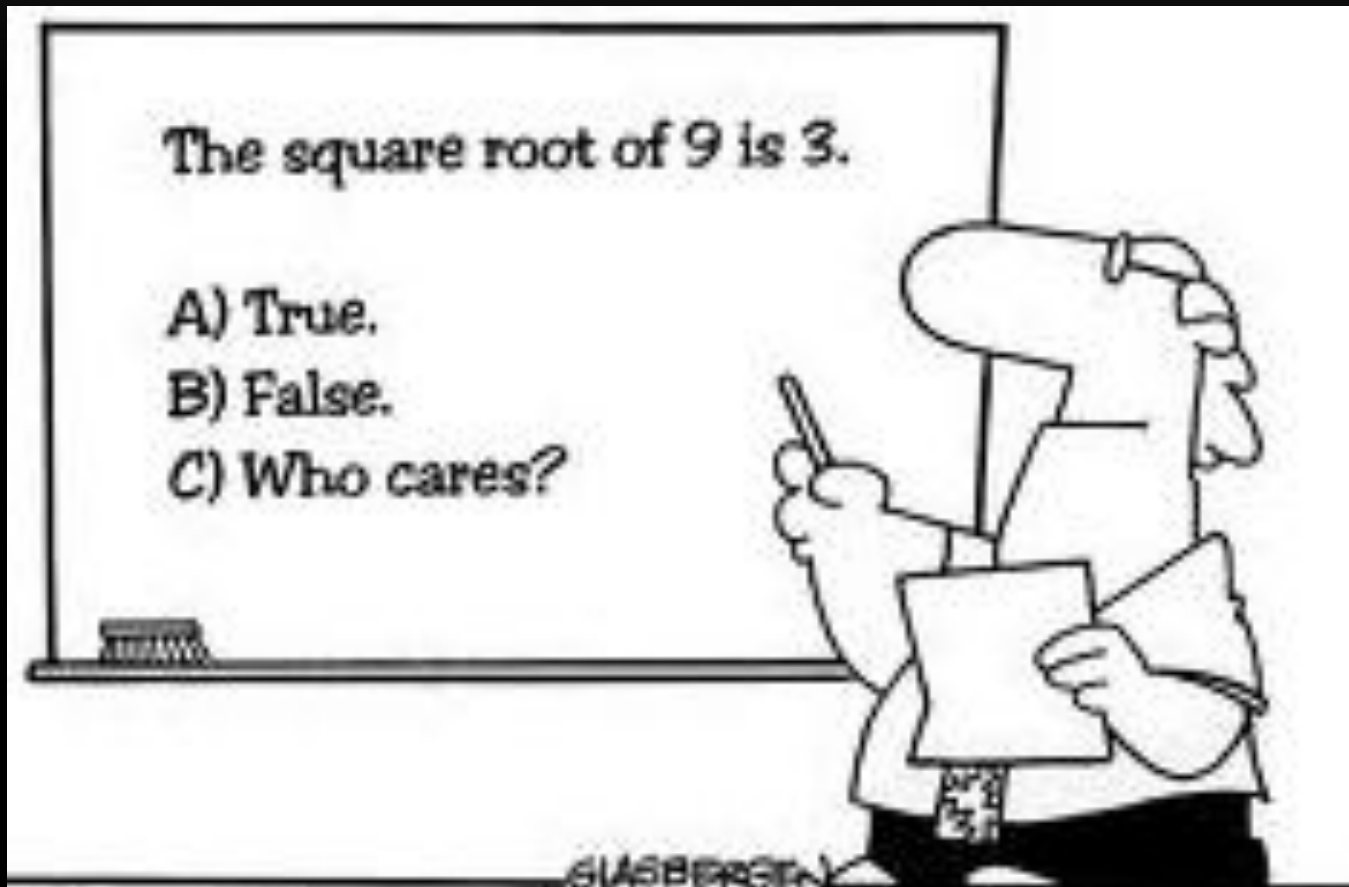
# NEONATAL MORBIDITY

- Hypoglycemia
  - Polycythemia
  - Hyperbilirubinemia
  - Hypocalcemia
  - Cardiomyopathy
  - Respiratory Distress
  - Birth Trauma
-

# DIABETES EFFECT ON THE PREGNANCY

- Dystocia
- Preeclampsia
- Pyelonephritis
- Pelvic trauma

# TESTING /SCREENING



# SCREENING

## 2 STEP TESTING

- Universal vs High risk
- 24 –28 wks
- **Step 1.** 1 hr 50 gram – no fasting necessary
- Venous plasma (<140 mg/dl) identifies 80% of women with GDM. A value >130mg/dl identifies 90% of women with GDM
- **Step 2.** 3 hour 100g after an overnight fast

# DIAGNOSTIC CRITERIA FOR GDM

Status	Carpenter and Coustan	National Diabetes Group
Fasting	95	105
One hour	180	190
Two hour	155	165
Three hour	140	145

# SCREENING 1 STEP TESTING

- 75 g glucose load after overnight fast
- Fasting 95 mg/dl
- 1 h 180 mg/dl
- 2 h 155 mg/dl

# WHEN TO SCREEN

- Assess risk at the first prenatal visit

Marked obesity

Family or personal history

glycosuria



# WHEN IS IT OUTRIGHT DIABETES?

- 1. A1C  $\geq$  6.5%
- 2. Fasting glucose  $\geq$  126 mg/dl (8 hr fast)
- 3. 2h value  $\geq$  200mg/dl after 75g load
- 4. Symptomatic pt with random glucose  $\geq$  200 mg/dl
  
- (1-3 should be confirmed with repeat testing)

## A FEW DETAILS

- Hgb A1C  $\geq$  6.5% identifies one third fewer patients than a fasting  $\geq$  126 mg/dl
  - Certain hemoglobinopathies or anemias may affect the A1C (Sickle cell, iron deficiency)
  - There may be discordance between tests.
-

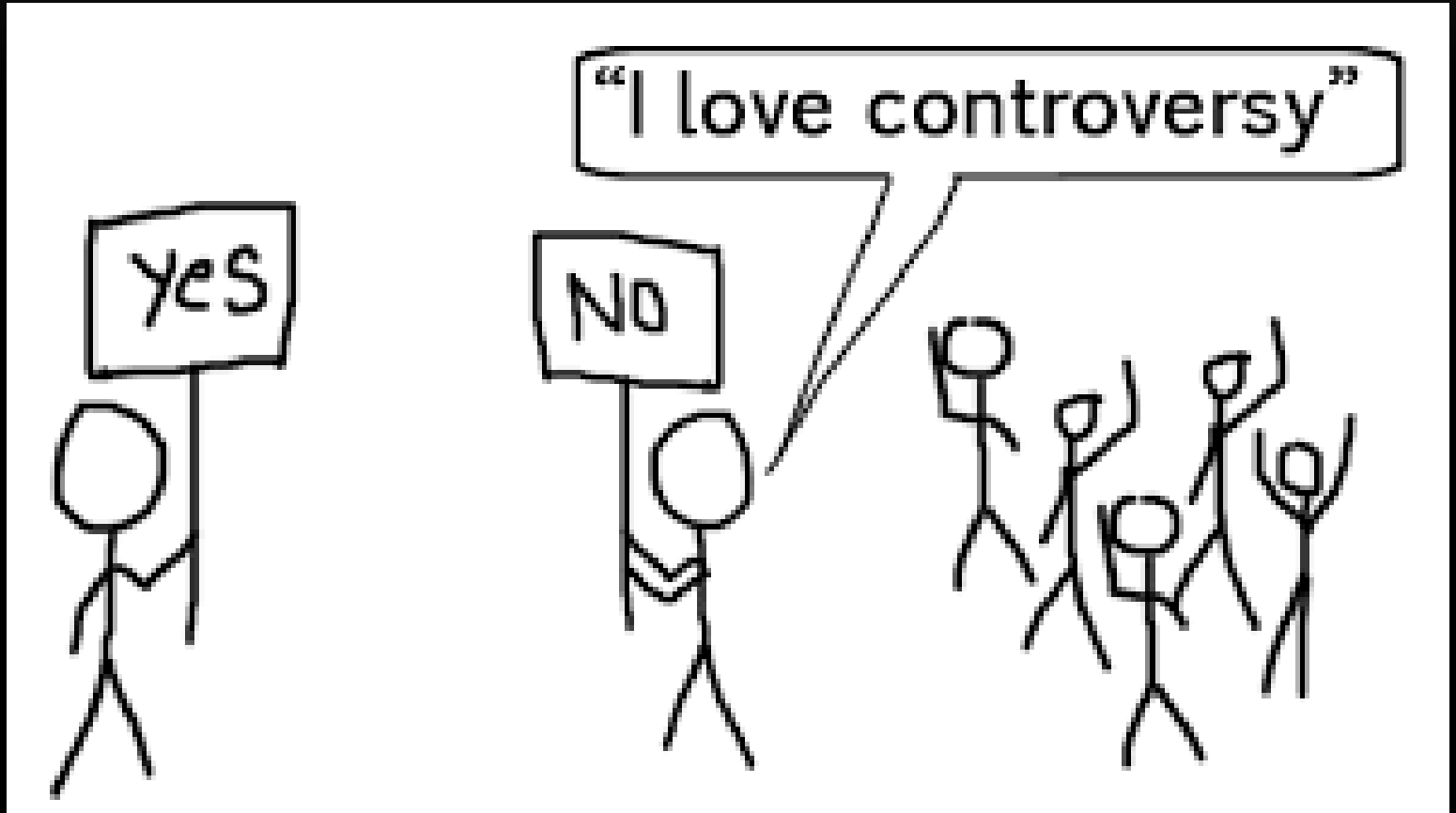
# SCREENING

- Hgb A1C at first prenatal visit. (< 20 weeks)
  - ≥ 6.5% dx of diabetes in pregnancy
    - counseling on diet
    - daily SMBG
    - medication as needed
  - 5.7-6.4% Impaired glucose tolerance
    - counseling on diet
    - monitor BG

# SCREENING

- <5.7% Test for GDM at 24-28 weeks

# WHICH METHOD IS BEST?



- World Health Organization (WHO)
- Australasian Diabetes in pregnancy society
- Diabetes in pregnancy study group of India
- International Association of Diabetes and Pregnancy study group (IADPSG)
- American Diabetes Association (ADA)
- ALL SUPPORT 75G ONE STEP TESTING AND THE USE OF THE A1C AT THE FIRST VISIT

- Americal Congress of Obstetricians and Gynecologists (ACOG)
  - Supports 2 step testing
  - It is estimated that if 75g single step testing is implemented the prevalence of GDM is expected to increase to 20% or higher.
-

# PART 2: MANAGEMENT





# ALL DIABETES IS NOT THE SAME

- Diabetes in pregnancy  $\neq$  Diabetes outside of pregnancy

Outside of pregnancy goals are :

To prevent complications of cardiovascular disease

blindness

neuropathy

renal failure



Newborn 13.4pounds (NSVD !!!)

# ALL DIABETES IS NOT THE SAME

During pregnancy – goals are:

Prevent macrosomia

Prevent fetal death

Prevent other fetal complications

# THIS MEANS YOU CANT TREAT THEM THE SAME

During pregnancy

- more frequent visits when not controlled
- stricter glycemc goals

# CONTROL OF MATERNAL GLYCEMIA (TARGET PLASMA GLUCOSE LEVELS)

- Fasting
  - Preprandial
  - 1 hr after meals
  - 2 hr after meals
- 60-90 mg/dl
  - 60-105 mg/dl
  - <140 mg/dl
  - <120 mg/dl;

# GLUCOSE MONITORING

- Daily SMBG superior to intermittent monitoring
- Fasting blood sugar
- Post prandial sugars most predictive of macrosomia .  
The most difficult glucose to control- post  
breakfast(dawn phenomenon) most predictive of fetal  
demise
- Verify glucometer with your facility's lab

# MEDICAL NUTRITION THERAPY(MNT)

- Goal: to provide calories and nutrients to sustain pregnancy, but does not cause post-prandial hyperglycemia

# DIETARY RECOMMENDATIONS

- 3 meals and 3 snacks
- Composition: CHO-30%-prot-20%;fat-30-40%
- Wt gain: 25-35 lb;if overwt(15-25);underwt (30-40)
- Caloric distribution;10%-breakfast,20-30 % for lunch,30-40 % for dinner,30% for snacks
- Exercise is also very important in the management of all women with diabetes



# CARBOHYDRATE BUDGET

- Breakfast                      1-2 carbohydrate choices
  - Lunch                              3-4 carbohydrate choices
  - Supper                            3-4 carbohydrate choices
  - Snacks (1-3 )                  1-2 carbohydrate choices
- 
- Amount of CHO typically found in a 2200 calorie diet

# NUTRITION GUIDELINES

- Carbohydrate counting/label reading
- CHO restriction at breakfast
- Avoid sugar, concentrated sweets, refined/processed starches
- Eliminate liquid CHO (juices), test milk
- Ok to use aspartame(Equal), sucralose (Splenda).  
saccharine (Sweet n Low)

Increase high fiber foods (25-30 grams)



# Honey- COMB

NUTRITIOUS SWEETENED CORN & OAT CEREAL BRAND

## Nutrition Facts

Serving Size 1 1/2 cup (32g)

Servings Per Container about 11

Amount Per Serving	Cereal with 1/2 cup Fat Free Milk	
	Cereal	Fat Free Milk
<b>Calories</b>	130	170
Calories from Fat	10	10
<b>% Daily Value**</b>		
<b>Total Fat</b> 1g*	<b>2%</b>	<b>2%</b>
Saturated Fat 0g	<b>0%</b>	<b>0%</b>
Trans Fat 0g		
Polyunsaturated Fat 0g		
Monounsaturated Fat 0g		
<b>Cholesterol</b> 0mg	<b>0%</b>	<b>0%</b>
<b>Sodium</b> 180mg	<b>8%</b>	<b>10%</b>
<b>Potassium</b> 50mg	<b>1%</b>	<b>7%</b>
<b>Total Carbohydrate</b> 28g	<b>9%</b>	<b>11%</b>
Dietary Fiber 1g	<b>4%</b>	<b>4%</b>
Sugars 10g		
Other Carbohydrate 17g		
Protein 2g		

- After a meal
  - Peak glucose levels approximately 1 hour
  - Preprandial levels 2-3 hours
  
  - Should you check 1 hour or 2 hour postprandial?
-

# WHEN TO INITIATE PHARMACOTHERAPY

- GDM A1 to A2
- >2 values exceed goal in 1 to 2 weeks
- FBS >95
- 2 hour PP>120
- Fetal abdominal circumference >70% at 29-33 wks  
(Buchanan diabetes care 1998)

# INSULIN THERAPY LISPRO(HUMALOG)

- Rapid Acting-good for pre-meals!
  - Onset-15min
  - Peak-30-90min
  - Duration-3-5 hours
  - Little antibody formation; more effective than regular insulin
  - Disadvantages: expensive , once thought to increase risk for proliferative retinopathy
-

# INSULIN THERAPY

## NPH

- Intermediate Acting Insulin
  - Onset 1-2 hours
  - Peak 4-8 hours
  - Duration 12 hours
  - Good for HS to Fasting window
  - May add in Am to cover midday
-



# INSULIN THERAPY ULTRALENTE

- Long Acting
  - Onset            4-6hr
  - Duration        24-36 hours
  - Peaks            16-18 hours
  - Large day to day variability
  - Not recommended
-

# LANTUS(GLARGINE-DNA ORIGIN)

- Long acting
  - Once a day insulin injection
  - No peak
  - Steady release of insulin
  - Acidic pH 4. After SQ injection it is neutralized forming micro precipitates.
  - Cannot be mixed with any other insulin
  - Category C
-

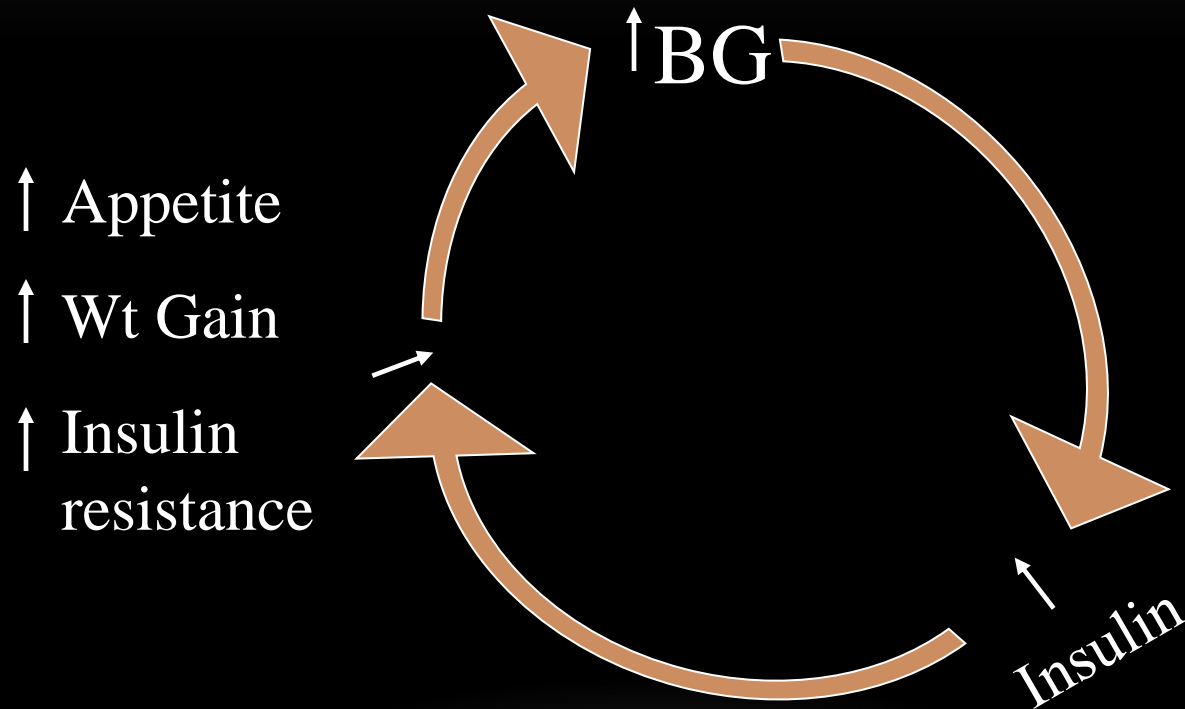
# INSULIN TOTAL DAILY DOSE REGIMEN

- 1<sup>st</sup> trimester .7 u/kg
- 2<sup>nd</sup> trimester .8u/kg
- 3<sup>rd</sup> trimester 1.0u/kg
  
- Dose range .25u/kg to 1.0u/kg

# \*\*\*\*\*INSULIN THERAPY –DAILY BREAKDOWN LISPRO COVERAGE

- TDD x 40% Pre Breakfast
- TDD x 30% Pre Lunch
- TDD x 20 % Pre Dinner
- TDD x 10% Bedtime
- NPH is added for coverage at bedtime

# BEWARE OF VICIOUS CYCLE



# MANAGEMENT OF GDM/TYPE 2

## ORAL AGENTS

- First line glyburide ( not used in Type 1)
- Max dose 20mg/day
- Usual dose 5-10mg targeted for time when glucose abnormal ( there is a 2.5mg dose)
- It's a sulfonylurea - don't use in patients with sulfa allergy
- Long tail –most common side effect is hypoglycemia

# ORAL HYPOGLYCEMIC AGENTS

## GLYBURIDE

- An effective alternative to insulin in the treatment of gestational diabetes (Langer NJMED,2000)
  - 30 –40 % failure rate in some series of studies
  - Patients prefer oral agents rather than injections!
  - Other agents    Metformin( biguanide)
  - Precose?
-

# MANAGEMENT OF GDM/TYPE 2

## ORAL AGENTS

- Metformin – insulin sensitizer
  - Maximum dose studied 2000mg/day but have seen patients on up to 2500.
  - Crosses the placenta in appreciable amounts
  - Doesn't cause hypoglycemia
  - Can be combined with glyburide
  - Most common side effect is GI upset
-



# MANAGEMENT OF GDM/TYPE 2 MEDICATION

- When to add medication
- Goals : fasting  $\leq 95\text{mg/dl}$
- 2 hr postprandial  $\leq 120\text{mg/dl}$
- Check 4 x day = 28 values/week
  
- 15-20% abnormal values consistently indicates a need for medication.

# MEDICATION MANAGEMENT

## RULES OF THE ROAD

- 1. There must always be a combination of medicine and diet.
- 2. Starting medication is just that. A start. Patient will not be controlled immediately after you start medication. It will have to be adjusted. This is particularly true of insulin
- 3. Exercise makes everything better
- 4. Oral agents wont work if blood glucose consistently  $\geq 170\text{mg/dl}$

# FETAL SURVEILLANCE

- Ultrasound  
Early dating and viability scan  
Every 4 weeks for growth

Quad screen marker at 15-20 weeks or Free fetal DNA > 10 weeks

Kick count at 28 weeks (+/-)

Pre-existing diabetes, GDM A-2, NST twice/week starting at 30-32 weeks, or BPP once/week starting at 32-34 weeks

# DELIVERY

- Induce at 38-39 6/7wks (pre-existing DM and GDM A-2)
- ADA (2004)
- NICE (2008)
  
- Amniocentesis for fetal lung maturity if there is uncertainty in gestational age (especially in the borderlands)
- Keep BG at 70-90 mg/dl during labor
- Most important determinant of risk for early neonatal hypoglycemia is intrapartum control

# POST PARTUM CARE

- Breastfeeding is encouraged
  - 2 hour 75 –gm glucola at 6 weeks post-partum)
  - Euglycemia, IFG, IGT, Overt Type 2
  - 50-60% of GDM will develop Type 2 diabetes in 5-10 years
-

# MAJOR GOALS

- Manage all diabetes patients with a team approach
- Major Goals: To prevent Macrosomia, hyperbilirubinemia, birth trauma, neonatal hypoglycemia in the baby
- To prevent: operative deliveries (including –vacuum extraction, forceps delivery, and cesarean deliveries), genital trauma, and prevent preeclampsia in the mother

# QUESTIONS



## Interesting facts about SUMO

- Eat 20,000 calories a day
- Ideal weight is 400-600 lbs
- They never eat breakfast
- Each meal 5-10 bowls of rice and up to 6 pints of beer
- **Surprisingly low incidence of diabetes (5%)**