



The Nurse's Guide to Understanding Gestational Diabetes

1 Contact Hours

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Purpose

The purpose of this CE activity is to provide information to the healthcare professional (HCP) about gestational diabetes (GDM) and to explore common health concerns related to this disease. The HCP will also be provided with the necessary tools to educate women about the impact of healthy lifestyle modifications on reducing the incidence of GDM, and to review available pharmacotherapies with patients.

Learning Objectives

After successful completion of this course, you will be able to:

1. Identify different types of diabetes
2. Define how gestational diabetes affects mother and baby
3. Identify the effects of pregnancy on blood glucose levels
4. Describe methods to keep blood sugar under control
5. Identify how gestational diabetes can affect women later in life

Introduction

Diabetes is often detected in women during their childbearing years and can affect the health of both the mother and her unborn child (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2014).

Poor control of diabetes in a woman who is pregnant increases the chances for birth defects and other problems for the baby (NIDDK, 2014).

Appropriate healthcare before and during pregnancy can help to prevent poor outcomes that can result in miscarriage, birth defects or stillbirth (NIDDK, 2014).

Gestational diabetes is of special concern since diabetes can affect the health of a mother and her unborn child (NIDDK, 2014).

Diabetes Defined

Diabetes is a condition in which the body cannot use the carbohydrates (sugars and starches) it takes in as food to make energy (NIDDK, 2016). The body either makes too little insulin in the pancreas or cannot use the insulin it makes to process fuel (carbohydrates) into energy (NIDDK, 2016). As a

result, the body collects extra sugar in the blood and excretes some sugar into the urine (NIDDK, 2016). The extra sugar circulating in the blood associated with the condition known as diabetes can damage organs of the body such as the heart, kidneys, and eyes (NIDDK, 2016).

There are three common types of diabetes:

1. **Type 1 diabetes:** The immune system attacks the cells on the pancreas causing it to make so little insulin that the body can't use blood sugar for energy (NIDDK, 2016). Type 1 diabetes can be diagnosed at any age, however it is most commonly diagnosed in childhood or early adulthood (NIDDK, 2016). People with type 1 must control their blood sugar with daily insulin shots or an insulin pump (NIDDK, 2016).
2. **Type 2 diabetes:** The body either makes too little insulin or cannot use the insulin it makes to use blood sugar for energy (NIDDK, 2016). Type 2 diabetes can often be controlled through exercising regularly and eating a proper diet (NIDDK, 2016). Some people with type 2 diabetes may have to take oral hypoglycemics, insulin or both (NIDDK, 2016).
3. **Gestational Diabetes (GDM):** A type of diabetes that occurs in a pregnant woman who did not have diabetes before becoming pregnant (NIDDK, 2014). GDM is diagnosed in second or third trimester of pregnancy (ADA, 2016). GDM can often be controlled through regular exercise and eating a proper diet; however, some women may need to take medication (NIDDK, 2014). GDM usually resolves after pregnancy, but not in all cases (NIDDK 2014 & 2016).

Research indicates that approximately 50% of women who have had GDM will develop type 2 diabetes within five to ten years after delivery (International Diabetes Federation, 2015).

Test Yourself

Gestational diabetes is:

- a. The term given to pre-existing diabetes disease in pregnant women.
- b. A type of diabetes that occurs during pregnancy in the absence of disease prior to becoming pregnant .
- c. Continuous low blood sugar levels in pregnant women.

Rationale: Gestational Diabetes is a type of diabetes that occurs in a pregnant woman who did not have diabetes before becoming pregnant (NIDDK, 2014). GDM is diagnosed in second or third trimester of pregnancy (ADA, 2016).

Prevalence of Gestational Diabetes

According to the International Diabetes Federation [IDF] (2015), gestational diabetes occurs in approximately 1 to 25 pregnancies worldwide.

- Of the live births in 2015, 20.9 million or 16.2% had some form of hyperglycemia in pregnancy and 85.1% were due to gestational diabetes (IDF, 2015).

In the United States the prevalence of gestational diabetes is increasing with 9.2% of women in 2010, 8.5% from 2009-2010 and 8.1% from 2007-2008 (DeSisto, Kim & Sharma, 2014).

- 1 in 20 pregnancies (4.6%) in the United States are affected by GDM (DeSisto et al., 2014)
- Wyoming had lowest GDM prevalence 2.2-5.5% and New York City highest prevalence 5.4%-11.7% (DeSisto et al., 2014).

Risk Factors for Gestational Diabetes

Although any woman can develop gestational diabetes during pregnancy, some of the factors that

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may increase the risk include the following:

- Obesity (NIDDK, 2014)
- Family history of diabetes type 2 (NIDDK, 2014)
- History of GDM with previous pregnancies (NIDDK, 2014)
- Previous delivery of a <9lb baby (NIDDK, 2014)
- Have African American, American Indian, Asian American, Hispanic /Latina or Pacific Islander American descent (NIDDK, 2014)
- Have a hormonal disorder called polycystic ovary syndrome (PCOS) (NIDDK, 2014)
- Age: Women who are older than 25 are at a greater risk for developing gestational diabetes than younger women (CDC, 2014)

Obesity is the most common modifiable risk factor. Evidence has consistently supported a significant correlation between levels of adiposity and the risk of developing GDM (Rubin, n.d).

Test Yourself

Risk factors for gestational diabetes include:

- a. Obesity, Polycystic Ovary Disease (PCOS) and older than 25 years old.**
- b. Previous still birth, small-for-gestational age fetus, heart disease.
- c. Family history of obesity, multiple pregnancies and pre-existing pancreatic disease.

Rationale: Risk factors gestational diabetes include: Obesity, Family history of diabetes type 2 (NIDDK, 2014), History of GDM with previous pregnancies ,Previous delivery of a <9lb baby, have African American, American Indian, Asian American, Hispanic /Latina or Pacific Islander American descent, have a hormonal disorder called polycystic ovary syndrome (PCOS) and Age: Women who are older than 25 are at a greater risk for developing gestational diabetes than younger women (NIDDK, 2014 & CDC, 2014).

Pathophysiology of Gestational Diabetes

Although the exact cause of gestational diabetes is unknown, there are some theories as to why the condition occurs.

The placenta supplies the developing fetus with nutrients and produces a variety of hormones to maintain the pregnancy (Lowdermilk, Perry, Cashion & Alden, 2012). Some of these hormones, namely estrogen, cortisol and human placental lactogen can have a blocking effect on insulin (Lowdermilk et al., 2012). This is called contra-insulin effect, which usually begins about 20 to 24 weeks into the pregnancy (Lowdermilk et al, 2012).

As the placenta grows, more of these hormones are produced, and insulin resistance becomes greater (Lowdermilk et al, 2012).

Normally, the pancreas is able to make additional insulin to overcome insulin resistance, but when the production of insulin is not enough to overcome the effect of the placental hormones, gestational diabetes results (Lowdermilk et al, 2012).

Complications of Gestational Diabetes during Pregnancy

The complications of gestational diabetes are usually manageable and preventable (ADA, 2016). The key to prevention is careful control of blood sugar levels as soon as the diagnosis of gestational diabetes is established (Garrison, 2015).

GDM may increase the mother's chances of:

- **Preeclampsia**- a condition of having high blood pressure & too much protein in urine (NIDDK,2014)
- **Stillbirth**- when the baby dies in the womb after 20 weeks of pregnancy (March of Dimes, 2015)
- **Premature birth**-birth before 37 weeks of pregnancy. Premature births increase the chances of the newborn having health problems at birth or later in life (March of Dimes, 2015)
- **Cesarean Section**- related to size of baby (NIDDK,2014)
- **Depression** (NIDDK, 2014)
- **Developing type 2 diabetes** (NIDDK, 2014)

The patient with GDM should be closely monitored for hypertension and pre-eclampsia (ADA, 2016).

Effects of Diabetes on the Newborn

Infants of mothers with GDM are vulnerable to several problems after birth including:

- **Macrosomia:** Refers to a baby who is considerably larger than normal. All of the nutrients the fetus receives come directly from the mother's blood (American Diabetes Association [ADA], 2016). If the maternal blood has too much glucose, the pancreas of the fetus senses the high glucose levels and produces more insulin in an attempt to use this glucose (ADA, 2016). The fetus converts the extra glucose to fat (ADA, 2016). Even when the mother has gestational diabetes, the fetus is able to produce all the insulin it needs (ADA, 2016). The combination of high blood glucose levels from the mother and high insulin levels in the fetus results in large deposits of fat, causes the fetus to grow excessively large (ADA, 2016). Due to the large size of the baby, delivery is often difficult and dangerous for the baby (NIDDK, 2014).
- **Hypoglycemia:** Occurs when maternal blood glucose levels remain high during pregnancy, causing the fetus to have a high level of insulin in its circulation (ADA, 2016). After delivery, the baby continues to have a high insulin level, but it no longer has the high maternal glucose supply (ADA, 2016). This results in a severe drop in the newborn's blood sugar level (ADA, 2016).
- **Respiratory Distress Syndrome:** too much insulin or glucose in baby's system may delay lung maturation causing breathing problems after birth; this is more likely to occur if baby is born before 37 weeks (NIDDK, 2014).

Research indicates that a large baby born to a woman with diabetes has an increased risk of being obese and/or developing type 2 diabetes later in life (ADA, 2016 & NIDDK, 2014).

Identifying Women at Risk: Prenatal Management

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It is important to identify and appropriately manage women with gestational diabetes early in the pregnancy (ADA, 2016). This will minimize complications in both the mother and infant (ADA, 2016).

The 2013 American Diabetes Association practice guidelines recommend screening for undiagnosed type 2 diabetes at the first prenatal visit in all women with diabetes risk factors (ADA, 2016). All other, asymptomatic pregnant women are screened for GDM after 24 weeks of gestation (Garrison, 2015).

Many drugs used to treat diabetes and diabetic complications are contraindicated in pregnancy, including statins, ACE inhibitors, and angiotensin receptor antagonists (ADA, 2016). Women who are at risk for developing gestational diabetes should be evaluated for use of drugs with potential teratogenic effects (ADA, 2016). If possible, these patients should receive counseling prior to conception (ADA, 2016).

Screening Tool for Gestational Diabetes

Identifying women at risk can help prevent uncontrolled gestational diabetes (ADA, 2016). A simple check list of risk factors for type 2 diabetes can provide important screening information for healthcare professionals to evaluate the risk of a woman developing gestational diabetes (ADA, 2013).

Important information to include on a screening tool to identify gestational diabetes includes:

- **Physical inactivity**
- **Family History:** Identifying an immediate family member with diabetes.
- **Ethnicity:** African American, American Indian, Asian American, Hispanic/Latino, or Pacific Islander are at higher risk for the development of gestational diabetes.
- **Age:** Women over the age of 25 years are at greater risk.
- **Obesity:** There is a higher risk of developing gestational diabetes in a woman who is overweight.
- **Previous history of pregnancies:** History of gestational diabetes or history of delivering a previous infant weighing more than 9 pounds.
- **Diagnosis of "pre-diabetes":** A condition in which blood glucose levels are higher than normal, but not yet high enough for a diagnosis of diabetes. Other names for it are "impaired glucose tolerance" and "impaired fasting glucose."
- **Hypertension:** >140/90 mmHg or on therapy for hypertension
- **HDL cholesterol levels:** 35 mg/dL (0.90 mmol/L) and/or a triglyceride level .250 mg/dL (2.82 mmol/L)
- **Polycystic Ovary Syndrome (PCOS)**
- **HbA1C \geq 5.7%, Impaired Glucose Tolerance (IGT), or Impaired Fasting Glucose (IFG) on previous testing**
- **History of Cardiovascular Disease (CVD)**

If the woman answers yes to any of these screening questions, she is at risk for the development of GDM.

Testing for Gestational Diabetes

Testing for gestational diabetes will depend on maternal risk factors (ADA, 2016 & Garrison 2015). A general guideline is as follows:

- **Risk for preexisting diabetes mellitus:** Establish baseline blood glucose levels at the first prenatal visit (Garrison, 2015). The incidence of type 2 diabetes mellitus has increased over the years in women of childbearing age and many women may have not been diagnosed (ADA, 2016). Diagnostic criteria for a diagnosis of type 2 diabetes mellitus includes:
 - An HbA1c equal to or greater than 6.5%
 - An eight-hour fasting blood glucose level equal to or greater than 126 mg/dL
 - A plasma glucose level equal to or greater than 200 mg/dL at the two-hour mark of a 75-g oral glucose tolerance test (OGTT)
 - A nonfasting blood glucose level of more than 200 mg/dL
- If a woman is positive for any of the above criteria, these women should have a diagnosis of overt diabetes mellitus rather than GDM (ADA, 2016). If the test results are normal, maternal blood levels will be checked again between weeks 24 and 28 of the pregnancy (Garrison, 2015).
- **All mothers:** Initial testing of baseline blood glucose levels between weeks 24 and 28 of pregnancy (Garrison, 2015).

Testing for Gestational Diabetes- Oral Glucose Tolerance Test

GDM can be diagnosed by 2 different types of oral glucose tolerance tests (OGTT), a “one-step” 75 gram OGTT and “two-step” approach with a 50-g (non- fasting) screen followed by a 100-g OGTT for those who screen positive (ADA, 2016). Data supports each of the strategies and long term outcomes studies are underway to evaluate pregnancy outcomes with each strategy (ADA, 2016). The “two-step” strategy is the most commonly used (Garrison, 2015).

One-Step Strategy

A 75 gram oral glucose tolerance test (OGTT), involves drinking a glucose drink followed by measurement of blood sugar levels after one and two hours (ADA, 2016). The OGTT should be performed in the morning after an overnight fast of at least 8 hours (ADA, 2016). According to ADA (2016) diagnosis of GDM is made when any of the following plasma glucose values are exceeded:

- Initial Fasting level: >92 mg/dL (5.1 mmol/L)
- Fasting after 1 hour: >180 mg/dL (10.0 mmol/L)
- Fasting after 2 hours: >153 mg/dL (8.5 mmol/L)

Two- Step Strategy

- **Step 1:** A 50 gram glucose load test (GLT) involves drinking a glucose drink followed by a measurement of blood sugar levels after one hour. If the plasma glucose level measured 1 h after the load is >140 mg/dL (7.8 mmol/L), proceed to a 100-g OGTT.
 - *ACOG recommends a lower threshold of 135 mg/dL (7.5mmol/L) in high risk-ethnic populations with higher prevalence of GDM (ACOG, 2014 & ADA, 2016)*
- **Step 2:** 100-g OGTT should be performed when the patient is fasting. The diagnosis of GDM is made if at least two of the following four plasma glucose levels (measured fasting and 1 h, 2 h, 3 h after the OGTT) are met or exceeded:

	Carpenter/Coustan	National Diabetes Data Group
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		(NDDG)
Fasting	95 mg/dL (5.3 mmol/L)	105 mg/dL (5.8 mmol/L)
1 hour	180 mg/dL (10.0 mmol/L)	190 mg/dL (10.6 mmol/L)
2 hour	155 mg/dL (8.6 mmol/L)	165 mg/dL (9.2 mmol/L)
3 hour	140 mg/dL (7.8 mmol/L)	145 mg/dL (8.0 mmol/L)

**For the 3 hour OGTT there is no one set of recommendations, physicians are instructed to choose a single set of diagnostic criteria to use consistently in their practice (ACOG 2014 & ADA, 2016).*

The Hemoglobin A1c Test

The hemoglobin A1c test, also known as HbA1c, glycated hemoglobin test, or glycohemoglobin, is an important blood test used to determine how well diabetes is being controlled (NIDDK, 2014b). Hemoglobin A1c provides an average of blood sugar control over a 3 month period (NIDDK, 2014b).

When blood glucose levels are high, excess glucose binds to hemoglobin causing it to become glycated. The average amount of glucose in the blood can therefore be determined by measuring a hemoglobin A1c level (NIDDK, 2014b).

For people without diabetes, the normal range for the hemoglobin A1c test is less than 5.7% (NIDDK, 2014b). The goal for most people with diabetes is a hemoglobin A1c less than 7% (NIDDK, 2014b). The higher the hemoglobin A1c, the higher the risks of developing complications related to diabetes (NIDDK, 2014b).

Due to physiological increases in red blood cell turnover, A1C levels fall during normal pregnancy (ADA, 2016). Post prandial glucose levels have been shown to affect development of macrosomia and A1C may not fully capture post-prandial hyperglycemia (ADA, 2016). Therefore A1C test is recommended as a secondary test (ADA, 2016).

The HbA1c test is used to determine how well blood sugar levels are being controlled over a 6 to 12 week period, but is considered a secondary diagnostic screening tool for GDM (ADA, 2016).

Initial Treatment for GDM

The initial treatment for gestational diabetes is lifestyle modification, diet and exercise (ADA, 2016). It is estimated GDM can be controlled in 70-80% of cases with lifestyle changes alone (Kelley, Carroll & Meyer, 2015). The Endocrine Society (2013) recommends the following when GDM has been diagnosed:

- **Glucose monitoring**
- **Exercise**
- **Medical Nutrition Therapy**
- **Limit Carbohydrate Intake**
- **Weight Management**
- **Pharmacological Therapy**

Women with gestational diabetes should be monitored for components of metabolic syndrome, such as central obesity, dyslipidemia, and hypertension (ADA, 2016). Patients with gestational diabetes and hypertension should be treated to a target blood pressure of systolic blood pressure 110–129 mmHg and a diastolic of 65–79 mmHg (ADA, 2016).

Adjustments in Lifestyle: Glucose Monitoring

Blood glucose testing is recommended before (pre-prandial) and either 1-2 hours after (post prandial) start of each meal, bedtime and during the night (Blumer, et al, 2013). Target blood glucose values are:

- Pre-prandial blood glucose: ≤ 95 mg/dl (5.3 mmol/L)
- 1 hour post prandial: ≤ 140 mg/dl (7.8 mmol/L)
- 2 hours post prandial: ≤ 120 mg/dl (6.7 mmol/L)

Adjustments in Lifestyle: Diet, Weight Management & Exercise

Diet

- **Medical Nutrition Therapy:** medical nutrition therapy is recommended to help achieve and maintain glycemic control while providing nutrient requirements that promote adequate weight gain without ketosis (Blumer et al., 2013). In addition, mothers who participate in medical nutrition therapy may develop eating habits that spark nutritional changes toward a healthy diet that could continue after delivery preventing them from long term consequences such as type 2 diabetes (Moreno-Castilla, Mauricio & Hernandez, 2016).
- **Limit Carbohydrate Intake:** it is recommended to limit carbohydrate intake to 35 to 45 % of total calories, distributed among 3 meals, small to moderate size, and 2-4 snacks including an evening snack (Blumer et al., 2013).
- **Caloric Intake:** It is recommend that women who are obese reduce their calorie intake by approximately one-third (compared with their usual intake before pregnancy) while maintaining a minimum intake of 1600 to 1800 kcal/d (Blumer et al., 2013).

Exercise: Daily moderate exercise is recommended for 30 min a day (Blumer et al., 2013).

Weight Management

Women with GDM are recommended to follow Institute of Medicine (IOM) revised guidelines for weight gain during pregnancy (Blumer et al., 2013).

Pre-pregnancy BMI	Total Weight Gain		Rates of Weight Gain in Second and Third Trimester	
	Range, kg	Range, lb	Mean (Range), kg/wk	Mean (Range), lb/wk
Underweight (<18.5 kg/m ²)	12.5–18	28–40	0.51 (0.44–0.58)	1 (1–1.3)
Normal weight (18.5–24.9 kg/m ²)	11.5–16	25–35	0.42 (0.35–0.50)	1 (0.8–1)
Overweight (25.0–29.9 kg/m ²)	7–11.5	15–25	0.28 (0.23–0.33)	0.6 (0.5–0.7)
Obese (≥30.0 kg/m ²)	5–9	11–20	0.22 (0.17–0.27)	0.5 (0.4–0.6)

Please see Appendix One for additional dietary recommendations for patients with gestational diabetes.

Test Yourself

Dietary recommendations regarding carbohydrate intake, for pregnant women with GDM are:

- Limit carbohydrate intake to 25 to 35 % of total calories, distributed among 3 meals, small to moderate size.
- There is no recommendation to limit carbohydrate intake in pregnant women with GDM
- Limit carbohydrate intake to 35 to 45 % of total calories, distributed among 3 meals, small to moderate size, and 2-4 snacks including an evening snack.**
- Distribute carbohydrates intake among 3 meals, small to moderate size, and 2-4 snacks including an evening snack.

Rationale: it is recommended to limit carbohydrate intake to 35 to 45 % of total calories, distributed among 3 meals, small to moderate size, and 2-4 snacks including an evening snack (Blumer et al., 2013).

Adjustments in Lifestyle: Pharmacological Therapy

If lifestyle therapy is insufficient to maintain normal glucose levels pharmacological therapy is recommended (Blumer et al., 2013). Insulin is preferred over oral hypoglycemic drugs because of its safety during pregnancy, since it does not cross the placenta (ADA, 2016). However, metformin (Glucophage) and glyburide are common oral agents used in GDM (ADA, 2016). Both metformin and glyburide cross the placenta and may have a greater risk for neonatal complications (ADA, 2016). However, metformin is preferred over glyburide, as it has been associated with a higher rate of neonatal hypoglycemia and macrosomia than insulin or metformin (ADA, 2016).

Insulin Recommendations

If insulin is necessary, the healthcare team will instruct the woman how to give herself insulin. It is important to note that all insulin (rapid, intermediate and long acting) is not harmful to the fetus since it cannot move from the maternal bloodstream to the baby's (Garrison, 2015).

One approach that is recommended when starting insulin therapy is to calculate a total daily insulin dose of 0.7-1.0 units/kg actual body weight (Garrison, 2015). Half of the total daily requirement is administered as a single dose of long-acting insulin (e.g., glargine [Lantus], detemir [Levemir]), and the other half is administered in three divided doses at mealtimes as rapid-acting insulin (e.g., lispro [Humalog], aspart [Novolog]) (Garrison, 2015).

More details about insulin products with respect to their onset duration and usual dosages can be found in Table 1.

Table 1: Commercially-Available Insulin Products (Pharmacists Letter, 2012)

Type of Insulin	Products	Onset of Action	Peak Time to Action	Duration of Action	Administration
rapid-acting	Lispro (Humalog®)	15-30 min	30 min-2.5 hr	3-6.5 hr	SQ within 15 min before meal or immediately after meal
	Aspart (Novolog®)	10-20 min	40-50 min	3-5 hr	SQ 5-10 min before meals May give IV
	Glulisine (Apidra®)	25 min	45-48 min	4-5.3 hr	SQ within 15 min before meal or 20 minutes after beginning meal May give IV or IM
Short-acting	Regular (Humulin R®, Novolin R®)	0.5-1 hr	2-4 hr	5-8 hr	SQ 30 min-1hr before meal May give IV or IM
Intermediate-acting	NPH (Humulin N®, Novolin N®)	1-2 hr	4-14 hr	Up to 24 hr	SQ once daily at bedtime, OR SQ BID (in the morning and with evening meal or at bedtime)
Long-acting	Glargine (Lantus®)	1 hr	None	24 hr	SQ once daily at same time each day

	Detemir (Levemir®)	1-2 hr	None/6-8 hr	Up to 24 hr	SQ once daily with evening meal or at bedtime, OR SQ BID (in the morning and with evening meal or at bedtime)
Premixed: intermediate and short-acting	Humulin 70-30®, Novolin 70-30®, Humalog Mix 75-25®, Novolog Mix 70-30®	Kinetics reflect that of the individual components			Humulin 70/30®, Novolin 70-30®: SQ 30 min before meals Humalog Mix 75-25®, Novolog Mix 70/30®: Within 15 min before meal

Adjustments in Lifestyle: Special Instructions for Insulin Administration

Although it is not common for women with gestational diabetes to develop hypoglycemia, there is an increased risk of developing hypoglycemia if they are taking insulin (Cleveland Clinic, 2016). Because of this, it is important for women with gestational diabetes to recognize the signs of low blood sugar (Cleveland Clinic, 2016). It is also important to educate them not to delay or skip meals and about the timing of when to take insulin and when to eat (Cleveland Clinic, 2016).

For women with gestational diabetes who take insulin, it's important to:

- Teach them when the effects of insulin are peaking (Cleveland Clinic, 2016). Low blood sugar is more common at these times, depending on how an individual's body uses insulin and glucose (Cleveland Clinic, 2016).
- Recommend physical activity, but caution patients to monitor their blood sugar levels closely during exercise (Cleveland Clinic, 2016). Because both insulin and physical activity lower blood sugar levels, when combined they can cause a rapid drop in blood sugar levels (Cleveland Clinic, 2016). Advise patients to test their blood sugar before beginning any physical activity (Cleveland Clinic, 2016). If the level is low, a snack should be immediately consumed and the blood sugar level re-tested prior to starting an activity (Cleveland Clinic, 2016). Advise patients to be smart about how much physical activity they do, how much they eat, and how much insulin is needed (Cleveland Clinic, 2016).
- Advise patients to be prepared for fluctuating blood sugar levels at all times (Cleveland Clinic, 2016). Insulin supplies should be carried at all times (Cleveland Clinic, 2016). Some form of sugar should be carried at all times as well, in case the blood sugar drops too low (Cleveland Clinic, 2016). The best form of sugar for an emergency is glucose paste or glucose tablets. These can be purchased at any drug store or pharmacy (Cleveland Clinic, 2016).
- Advise patients to test blood sugar levels regularly and any time they begin to feel dizzy, faint, or tired (Cleveland Clinic, 2016).
- Encourage patients to report any abnormal blood sugar level to their healthcare provider right away, in case a change in the treatment plan is needed (Cleveland Clinic, 2016).

Fetal Surveillance for Potential Complications

Surveillance for potential complications related to GDM should begin as soon as the disease is detected (Garrison, 2015). In mothers with GDM who are controlled without medications antenatal

testing is not beneficial due to the fact that negative neonatal outcomes are not increased (Garrison, 2015).

For women who require medication for control of GDM, antenatal testing is recommended (Garrison, 2015). Twice-weekly monitoring should start at 32 weeks gestation and include a non-stress test (Electronic fetal monitoring is recommended to compare the infant's heart rate during movement and rest) (Garrison, 2015). Some protocols may include a biophysical profile (BPP) (Brown, 2015). A BPP test measures the health of the fetus during pregnancy, and may include a non-stress test with electronic fetal monitoring and a fetal ultrasound (Brown, 2015). The BPP measures the baby's heart rate, muscle tone, movement, breathing, and the amount of amniotic fluid surrounding the fetus (Brown, 2015).

In the third trimester ultrasounds are recommended to assess risk of fetal macrosomia (Garrison, 2015)

Daily fetal kick counts starting at 34 weeks should be performed (Brown, 2015 & Garrison, 2015).

Induction of labor before 39 weeks should only occur if glycemic control is poor despite lifestyle changes and medication use, or if another indication for delivery is present (Garrison, 2015).

ACOG has not made any evidence based recommendations on ideal timing of delivery for patients with GDM, many physicians offer induction between 39 and 40 weeks, particularly for patients with other risks of stillbirth (Garrison, 2015). A scheduled cesarean delivery compared to vaginal delivery reduces the risk of complications such as permanent brachial plexus injury for women with GDM and an estimated fetal weight greater than 9 lbs. (4,500 grams) (Garrison, 2015).

Intrapartum Management of GDM

Blood glucose monitoring is a critical part of the intrapartum management of GDM. Maintaining optimal blood glucose levels can decrease the risks of neonatal hypoglycemia and acidosis (Garrison, 2015).

The following guidelines may be used for monitoring blood glucose during the intrapartum period in an uncomplicated labor:

- Finger stick blood sugar every 1 to 2 hours (Garrison, 2015)
- Goal is to maintain blood sugar between 70 to 110 mg/dl (Garrison, 2015)

Postpartum Management of GDM

Postpartum care is very similar for any new mother. However, there are a few differences related to both the current issues with blood sugar and the risk for type 2 diabetes in the future (ADA, 2016).

For the postpartum mother with GDM the following guidelines are generally used:

- Obtaining fasting blood glucose 24-72 hours after delivery to rule out ongoing hyperglycemia (Blumer et al., 2013).
- Actively encourage her to breastfeed, since breast milk decreases the risk of developing type 2 diabetes later in life for both infant and mother (Garrison, 2015 & ADA, 2016).

- Advise her on contraceptive/family planning issues. Planning pregnancy is critical in women with GDM or pre-gestational diabetes due to the need to have preconception diabetes control (ADA, 2016). There are no differences in contraception options and recommendations for women with GDM (ADA, 2016).

Testing for Diabetes after Pregnancy

Most healthcare providers will usually ask the woman to have a blood glucose test approximately 6 to 12 weeks after the baby is born to see whether or not she might still have diabetes (ADA, 2016 & Garrison, 2015). For most women, gestational diabetes resolves after pregnancy. Women are still at risk, however, of having gestational diabetes during future pregnancies or developing type 2 diabetes later in life (ADA 2015 & Garrison, 2015).

It is estimated that after pregnancy, 5-10% of women who had gestational diabetes will be found to have type 2 diabetes later in life. Women who have had gestational diabetes also have a 20-50% chance of developing diabetes in the next five to ten years following pregnancy (IDF, 2015). Due to increased risk for development of type 2 diabetes additional screening every 1-3 years for women who test normal at their 6-12 week screening is recommended (Garrison, 2015 & ADA, 2016).

Preventing Problems Related to Diabetes

An individual diagnosed with diabetes who keeps her blood sugar as close to normal as possible usually has fewer problems than a person who does not keep her blood sugar in control. To help keep blood sugar in control, a strict lifestyle plan is essential and includes:

- Eating healthy foods (ADA, 2016).
- Exercising regularly (ADA, 2016).
- Frequent blood sugar monitoring (ADA, 2016).
- Taking prescribed medications as indicated (ADA, 2016).
- Learning to adjust food intake, exercise, and insulin depending on blood sugar results (ADA, 2016)
- Regular follow up care with a healthcare provider (ADA, 2016).

Important Points to Remember About GDM

Women who have had gestational diabetes can lower their risk of developing diabetes later in life by controlling modifiable risk factors, such as obesity and physical inactivity (ADA, 2016).

These women should receive additional follow-up and teaching with a focus on lifestyle planning. Women should learn about factors such as:

- Getting tested for diabetes 6 to 12 weeks after the baby is born, then at least every three years thereafter (ADA, 2016).
- Talking to their physician if they plan to become pregnant again (ADA, 2016).
- Breastfeeding to lower their child's risk for diabetes (Garrison, 2015 & ADA, 2016).

- Choosing a healthy meal plan: consuming meals that are high in fiber and low in saturated fats, fats, cholesterol, salt (sodium), and added sugars. Also adding a colorful mix of fruits and vegetables, fish, lean meats, chicken or turkey without the skin, dry peas or beans, whole grains, and low-fat or skim milk and cheese (NIDDK, 2017).
- Staying Physically Active: Physical activity is essential for managing diabetes risk and staying healthy (NIDDK, 2017). Set small goals to start and work your way up to at least 30 to 60 minutes of physical activity on most days of the week (NIDDK, 2017). An example of a good way to move more is brisk walking. Try brisk walking, dancing, swimming, biking, jogging, or any physical activity that helps get your heart rate up (NIDDK, 2017). You don't have to get all your physical activity at one time (NIDDK, 2017). Try getting some physical activity throughout the day in 10 minute sessions (NIDDK, 2017).
- Helping their children lower their risk for type 2 diabetes by learning to make healthy food choices, being physically active 60 minutes a day, and not becoming overweight (ADA, 2016).

Test Yourself

Women with a history of gestational diabetes:

- Will remain diabetics for the rest of their lives.
- Will always develop Type 1 diabetes after the pregnancy.
- Can lower their risk for developing Type 2 diabetes later in life.

Rationale: Women who have had gestational diabetes can lower their risk of developing diabetes later in life by controlling modifiable risk factors, such as obesity and physical inactivity (ADA, 2016).

Conclusion

Women who are at risk of developing gestational diabetes require additional monitoring and care during pregnancy.

Without appropriate screening and treatment the risks of complications to the mother and infant have the potential to increase dramatically.

Through lifestyle changes and management of GDM a woman can prevent complications for her infant and herself.

Appendix One

Dietary Recommendations for Gestational Diabetes

The first step in managing gestational diabetes is to educate the mother regarding dietary changes that she should make to help keep her blood sugar level within normal range, while still eating a healthy diet.

One of the most effective ways of keeping blood sugar levels in normal range is by monitoring the amount of carbohydrates in the diet.

Carbohydrates are found in the following healthy foods:

- Milk and yogurt
- Fruits and juices
- Rice, grains, cereals and pasta
- Breads, tortillas, crackers, bagels and rolls
- Dried beans, split peas and lentils
- Potatoes, corn, yams, peas and winter squash

Sweets and desserts, such as sugar, honey, syrups, pastries, cookies, soda and candy also typically have large amounts of carbohydrate, and should be avoided at all times.

Consulting with A Registered Dietitian

It is important to educate the patient about the importance of consulting with a registered dietitian to have an assessment of their diet completed. The dietitian will calculate the amount of carbohydrates needed and teach the patient how to count carbohydrates.

The following dietary recommendations will help maintain safe blood sugar levels during pregnancy:

- Distribute foods between three meals and two or three snacks each day.
- Eating too much at one time can cause blood sugar spikes. It is very important that no meals are skipped to maintain stable blood glucose levels.
- Reasonable portions of starch should be consumed. Starchy foods eventually turn into glucose so it's important not to be excessive. However, starch should be included in every meal. A reasonable portion is about one cup of total starch per meal, or two pieces of bread.
- Limit milk consumption. Although milk is a healthy food and an important source of calcium, it is also a liquid form of carbohydrate and drinking too much at one time can raise blood sugar.
- Limit fruit portions, as fruit is high in natural sugars. Limit fruit intake to three portions of fruit per day.

Breakfast matters

Blood sugar can be difficult to control in the morning because of normal fluctuations in hormone levels. Refined cereals, fruits and even milk may not be well tolerated in the morning meal. If the patient's post-breakfast blood sugar level increases too much after having these foods, then these foods should not be consumed in the morning. A breakfast that consists of starch plus protein is usually tolerated the best.

Advise patients to avoid fruit juice, as it is a concentrated source of carbohydrate. Since it is liquid, juice can raise blood sugar quickly.

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Strictly limit sweets and desserts as these foods often contain large amounts of fat and offer very little in terms of nutrition. Additionally, all regular sodas and sugar-sweetened beverages should be avoided.

Safe Sweeteners

The following sweeteners have been approved as safe to eat during pregnancy:

- Aspartame, which includes Equal, NutraSweet, Natra Taste
- Acesulfame K, which includes Sunett
- Sucralose, which includes Splenda

Keeping food records

Instruct the mother to record all of the foods and food amounts consumed each day, as this will help her monitor her carbohydrate intake. Also, encourage the use of measuring cups for accuracy when possible.

(University of California San Francisco [UCSF] Medical Center, n.d)

Additional Resources for Patient Education

American Diabetes Association:

<http://www.diabetes.org/diabetes-basics/gestational/>

United States National Library of Medicine:

<https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0022142/>

American Academy of Family Physicians:

<https://familydoctor.org/condition/gestational-diabetes/#overview>

Medline Plus for Patients:

<https://medlineplus.gov/diabetesandpregnancy.html>

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