Joslin Diabetes Center and Joslin Clinic
Guideline for Detection and Management of Diabetes in Pregnancy
9/10/2010: Revised 06-15-11

The Joslin Guideline for Detection and Management of Diabetes in Pregnancy is designed to assist internal medicine specialists, endocrinologists and obstetricians in individualizing the care of and setting goals for women with pre-existing diabetes who are pregnant or planning pregnancy. It is also a guide for managing women who are at risk for or who develop Gestational Diabetes Mellitus (GDM). This Guideline is not intended to replace sound medical judgment or clinical decision-making. Clinical judgment determines the need for adaptation in all patient care situations; more or less stringent interventions may be necessary.

The objectives of the Joslin Guideline for Detection and Management of Diabetes in Pregnancy are to support clinical practice and to influence clinical behaviors in order to improve clinical outcomes and assure that patient expectations are reasonable and informed. Guidelines are developed and approved through the Clinical Oversight Committee that reports to the Chief Medical Officer of the Joslin Diabetes Center. The Guideline is established after careful review of current evidence, medical literature and sound clinical practice. This Guideline will be reviewed periodically and modified as clinical practice evolves and medical evidence suggests.

SCREENING FOR GESTATIONAL DIABETES MELLITUS	
	See *Screening Strategy to Detect GDM* Algorithm

PRECONCEPTION CARE	Pre-existing type 1 or type 2 diabetes
Glucose Goals Prior to Conception	**Plasma*** • Fasting and pre-meal blood glucose: 80-110 mg/dl • 1 hour postprandial blood glucose: 100-155 mg/dl • A1C < 7%; and as close to normal as possible without resulting severe hypoglycemia • Avoid severe hypoglycemia
Counseling	• Educate women of childbearing age about the importance of near normal blood glucose control prior to conception • Refer to a maternal fetal-medicine and/or endocrinologist/diabetes specialist for counseling, assessment of maternal and fetal risk and guidance in achieving management goals. This includes all women who are planning pregnancy and women who are not planning pregnancy but are using inadequate contraception and have an A1C greater than 7%. • Assess diabetes self-management, including meal plan, insulin care and use, activity program, medication schedule, self-monitoring of blood glucose (SMBG), treatment for hypo- and hyperglycemia, and sick day management, using diabetes educators (DE) as appropriate. Review maternal and fetal health issues. • Begin a multivitamin with 400 mcgs folic acid to supplement average daily intake of 400 mcgs for a total daily intake of 800 mcg to 1 mg of folic acid to decrease the risk of neural tube defects. Patients with a prior pregnancy affected with a neural tube defect should take folic acid 4 mgs daily. Check a B12 level in patients consuming more than 1 mg folic acid, as high dose folic acid may mask B12 deficiency. • Strongly advise smoking and alcohol cessation • Refer overweight and obese women with and without known diabetes or polycystic ovary syndrome (PCOS) for medical nutrition therapy with a goal of 5-10% weight loss based on Institute of Medicine (IOM) 2009 recommendation.
Medical Assessment	• Medical and obstetrical history: including comprehensive review of diabetes history and management • Eye evaluation: dilated comprehensive eye exam and pregnancy clearance by an ophthalmologist; should also include a discussion about the risk of developing and/or the progression of diabetic retinopathy during pregnancy • Renal evaluation: spot urine microalbumin and serum creatinine; protein/creatinine ratio if spot urine microalbumin >300 mcg/mg • Thyroid evaluation: TSH level • GYN evaluation: pelvic exam, Pap smear up to date • Cardiac evaluation: if ≥ 35 years of age with one or more additional risk factors (hypertension, smoking, family history of CAD, hypercholesterolemia, microalbuminuria or nephropathy) - recommend one or more of the following: EKG, echocardiogram, exercise tolerance test
Diabetes Medications	• Discontinue oral antihyperglycemic therapy; start insulin. An exception is metformin, which may be continued during the first trimester in patients with PCOS or type 2 diabetes, and anovulatory infertility. At the first prenatal visit the patient should begin increasing doses of insulin as necessary to control blood glucose while metformin is tapered off or discontinued. Metformin should not be used beyond the first trimester or in lieu of insulin until randomized controlled studies evaluating safety and efficacy have been completed. o Metformin crosses the placenta and achieves therapeutic levels in the fetus. Presently, there are no long term randomized controlled safety data in infants whose mother's were treated with metformin in pregnancy. • Oral medications have not been adequately studied for the treatment of preexisting type 2 diabetes in pregnancy. • The rapid-acting insulin analogs lispro and aspart lower postprandial blood glucose and decrease the risk of nocturnal hypoglycemia and may be useful therapeutic agents. Patients on lispro and aspart prior to conception may continue them during pregnancy. Patients on regular insulin may be switched to lispro or aspart if 1-hour postprandial blood glucose levels are above target and the patient is also experiencing pre-meal or nocturnal hypoglycemia.

	• Glargine, a long-acting insulin analog, is not recommended in women who are planning a pregnancy or who are currently pregnant. There is no information on its safety in pregnancy. A specific concern in the pregnant population is related to the 6 to 8 fold increased IGF-1 receptor affinity and mitogenic potency compared with human insulin. • There is no information on the safety of using the two new insulin analogs, glulisine and detemir, in pregnancy. We cannot recommend their use at this time except in clinical trials. • The rapid-acting insulins, lispro or aspart may be delivered either through multiple daily injections (MDI) or an insulin pump. • There is inadequate safety information about the use of exenatide and liraglutide in pregnancy. They should therefore not be used in pregnancy.
Other Medications	**Hypertension and/or microalbuminuria management:** • ACE-inhibitors must be stopped before pregnancy due to the increased risk of birth defects in the 1st trimester and the risk of fetal injury or demise with 2nd or 3rd trimester use. ARBs should be stopped before conception because safety data for 1st trimester use is limited. o The non-dihydropyridine calcium channel blocker diltiazem in extended release forms may be a useful substitute for ACE-Is and ARBs. **Diabetic nephropathy/chronic renal disease management:** • Sometimes the benefits of preconception use of ACE-inhibitors for renal protection may outweigh the mildly increased risk of birth defects. In this case, ACE-inhibitors should be stopped as soon as pregnancy is diagnosed in the first trimester. **Hyperlipidemia management:** • Stop all cholesterol-lowering agents before conception, including statins • Hypertriglyceridemia–omega 3 fatty acids may be started or continued in pregnancy

DIABETES MANAGEMENT DURING PREGNANCY

Self Monitoring of Blood Glucose and Urine Ketones

Pre-existing diabetes and GDM

- For gestational diabetes, check glucose levels 4 times/day: before breakfast and 1 hour post-meals
- For pre-existing diabetes, check glucose levels pre-meals and 1 hour post-meal
- Nocturnal monitoring (~3 AM) may be necessary on an intermittent basis
- Check fasting urine ketones daily

Treatment Goals

Pre-existing Diabetes

	Plasma glucose* Hadlock AC< 70th percentile	Plasma glucose* Hadlock AC ≥ 70th percentile
• Fasting and pre-meal plasma glucose	60-99 mg/dl	60-79 mg/dl
• 1-hour post-meal or peak post-prandial plasma glucose	100-129 mg/dl	90-109 mg/dl
• Urine ketones	negative	negative

- Normalization of hemoglobin A1C to < 6% if possible without resulting severe hypoglycemia
- Use standard hypoglycemia treatment for blood glucose less than 60 mg/dl (15 grams of carbohydrate – recheck in 15 minutes; repeat with 15 grams of carbohydrate if blood glucose is still less than 60 mg/dl)
- Avoidance of severe hypoglycemia (episode in which patient experiences coma, seizure or suspected seizure, or impairment sufficient to require the assistance of another person). Blood glucose goals must be relaxed for patients with hypoglycemia unawareness or recurrent hypoglycemia.

Gestational Diabetes

	Plasma glucose* Hadlock AC < 70th percentile	Plasma glucose* Hadlock AC ≥ 70th percentile
• Fasting and premeal blood glucose	60-95 mg/dl	60-79 mg/dl
• 1-hour post meal or peak post prandial	100-129 mg/dl	90-109 mg/dl
• Urine ketones	negative	negative

- Initiate insulin therapy if above levels are not maintained
- Use standard hypoglycemia treatment for blood glucose less than 60 mg/dl (15 grams of carbohydrate – recheck in 15 minutes; repeat with 15 grams of carbohydrate if blood glucose is still less than 60 mg/dl)

Diabetes Monitoring and Visits

Pre-existing Diabetes

- Medical visits (endocrinologist preferred) every 1-4 weeks, with additional phone contact as needed, depending on level of self-management skills and stability of blood glucose control. At each visit, review SMBG and urine ketone results, measure blood pressure, measure urine protein and ketones by dipstick
- Check A1C level every 4-8 weeks
- Education using a diabetes educator (DE), preferably a Certified Diabetes Educator (CDE), as needed; medical nutrition therapy (MNT) by registered dietitian (RD)
- Ophthalmology exam early in first trimester; follow-up depending on findings of this exam
- Consider providing mental health counseling to assist women and / or their partners cope with the psychological and relationship changes that may result from pregnancy.

	Gestational Diabetes • Medical visits (endocrinologist preferred) every 1-4 weeks, with additional phone contact as needed, depending on level of self-management skills and stability of blood glucose control. At each visit, review SMBG and urine ketone results, measure blood pressure, measure urine protein and ketones by dipstick. • If newly diagnosed with gestational diabetes, patient should be started on insulin, not metformin, if medication is required. • Education using DE (preferably a CDE) as needed for review of SMBG to increase adherence; MNT by registered dietitian (RD) • Insulin is preferred over glyburide in GDM as studies comparing glyburide to insulin were not powered to evaluate neonatal outcomes. There was a trend to greater infant birth weights when mothers were treated with glyburide compared to insulin. • When insulin is not an option, glyburide may be used.
Diabetes Medications	**Preexisting Diabetes** • The only diabetes medication currently used throughout pregnancy is insulin (see **Preconception Care**).
Hypertension Management	• Maintaining blood pressure in non-pregnant patients at ≤ 130/80 decreases end organ damage. • Target blood pressure is 110-129 systolic and 65-79 diastolic in women with chronic hypertension during pregnancy. Antihypertensives are initiated in pregnant patients with known or suspected chronic hypertension if blood pressure is ≥ 130/80 three times during pregnancy. • Pre-eclampsia needs special treatment; therefore, these guidelines and treatment strategies do not apply to pre-eclampsia for which other treatment options are preferred, or to gestational hypertension when high blood pressure exposure is limited • Antihypertensives that are used during pregnancy are: ➢ Alpha methyldopa (category B) ➢ Beta-blockers (acebutolol, sotalol – category B; betaxolol, bisoprolol, labetalol, levatol, metoprolol, nadolol, timolol – category C; atenolol – category D – should not be used as it may cause fetal growth restriction) ➢ Calcium channel blockers (all category C) (The nondihydropyridine calcium channel blocker diltiazem in extended-release form may be preferred in patients with microalbuminuria or nephropathy.) ➢ Hydralazine (category C)

*Laboratory methods measure plasma glucose. Most glucose monitors approved for home provide readings equivalent to plasma values. Plasma glucose values are 10-15% higher than whole blood glucose values. It is important for people with diabetes to know whether their meters and strips record whole blood or plasma results.

MEDICAL NUTRITION THERAPY (MNT)

Recommendations are the same for pre-existing diabetes and GDM except where noted.

Counseling and Education

- All pregnant women should receive MNT counseling by a registered dietitian (RD), (CDE preferred)
- All pregnant women should receive SMBG training by a DE (CDE preferred)
- Daily food records and SMBG records are required to assess effectiveness of MNT
- Carbohydrate counting skills are taught for either a consistent carb intake or a personalized insulin to carb ratio so the patient can adjust insulin based on carbohydrate intake
- At least 3 encounters with a CDE are recommended:
  - Visit 1 (60 – 90 min individual or group visit with RD) for assessment and meal planning. This could include SMBG instruction if RD has received appropriate training.
  - Visit 2 (30 – 45 min) with RD or RN 1 week after initial visit to assess and modify plan
  - Visit 3 (15 – 45 min) with RD or RN in 1 – 3 weeks to further assess and modify plan, as needed.
- Additional visits every 2 – 3 weeks and prn with RD or RN until delivery, and one visit 6 – 8 weeks after delivery

Calories

WHO BMI range (kg/m$^{2)}$	Energy Needs (kcals/kg) °Based on Pregravid kg	Total Weight Gain Range (lbs)	**Twin**	Rates of weight Gain (lb/week) 2nd and 3rd trimesters
Underweight <18.5	36-40	28-40		1.0 (1-3)
Normal weight 18.5-24.9	30	25-35	37-54	1.0 (0.8-1)
Overweight 25.0-29	24	15-25	31-50	0.6 (0.5-0.7)
Obese ≥30.0	**	11-20	25-42	0.5 (0.4-0.6)

For singleton pregnancy, add an additional 340 kcal/day to calculated needs in 2nd trimester and 452 kcal/day in 3rd trimester, or additional calories consistent with target weight gain. For twin pregnancy, add an additional 500 kcals to calculated needs after 1st trimester. For multiple pregnancies, add 500 kcal in the 1st trimester. (**Provisional guidelines for twin pregnancies per Institute of Medicine (IOM)).

* Insufficient information was available to develop a provisional guideline for underweight women with multiple fetuses.

** Insufficient information to address energy needs (kcal/kg) in the obese category

<table>
<tr><td>Distribution of Calories</td><td colspan="2">• Individualize distribution of calories based on usual intake, preferences and medication regimen
o 6 – 8 small meals/snacks is recommended. Smaller frequent meals decrease postprandial hyperglycemia
Weight should be monitored at each visit; track patient's weight gain on prenatal weight gain chart</td></tr>
<tr><td rowspan="5">Carbohydrate
Breakfast
Other meals
HS snack</td><td><u>GDM</u></td><td><u>Pre-Existing Diabetes</u></td></tr>
<tr><td>40 – 45% total calories♠</td><td>40% – 55% total calories</td></tr>
<tr><td>15 – 30 grams♠ +</td><td>Individualized as per usual intake and BG levels</td></tr>
<tr><td>45 grams lunch and dinner</td><td>Individualized as per usual intake and BG levels</td></tr>
<tr><td>15 – 30 grams carbohydrate</td><td>15 – 30 grams carbohydrate</td></tr>
<tr><td colspan="3">♠ Pregnant women should consume a minimum of 175 grams of carbohydrate per day
+ May be increased if insulin is added</td></tr>
<tr><td>Fiber</td><td colspan="2">• Calculate 14 grams of fiber per 1000 kcals per day (25-30 grams/day) based on provider assessment</td></tr>
<tr><td>Protein</td><td colspan="2">• Calculate 1.1 grams of protein per kg per day, based on provider assessment</td></tr>
<tr><td>Fat</td><td colspan="2">• <u>Pre-existing diabetes</u>: 30 – 40% of total calories, with <10% total calories from saturated fat
• <u>GDM</u>: 30-40% total calories with <10% total calories from saturated fat
• Encourage use of monounsaturated and polyunsaturated fats instead of saturated fats</td></tr>
<tr><td>Nutritive and Non-nutritive Sweeteners</td><td colspan="2">• The safety of non-nutritive sweeteners has not been established.</td></tr>
<tr><td>Vitamin/ Mineral Supplements</td><td colspan="2">Prenatal multivitamin and mineral supplement including:
• Iron (27 mg/day)
• Folic acid 400 mcgs to supplement average daily dietary intake of 400 mcgs for a total daily intake of 800 mcgs to 1 mg daily to decrease risk of neural tube defects (begin 400 mcg prior to conception)
• Additional calcium supplementation may be needed to meet daily requirement of 1000 mg per day (1300 mg per day if under age 19yrs). Begin prior to conception.
• Vitamin D 600 IUs/day.</td></tr>
<tr><td>Caffeine</td><td colspan="2">• Limit to <200 mg per day. Excess caffeine consumption during pregnancy may increase the risk of miscarriage.</td></tr>
<tr><td>Physical Activity</td><td colspan="2">• Regular physical activity is recommended after clearance by provider
o Benefits include reducing insulin resistance, postprandial hyperglycemia and excessive weight gain
• Hypoglycemia is more likely with prolonged exercise (>60 minutes)
• Encourage activity after meals to reduce postprandial hyperglycemia</td></tr>
<tr><td>Alcohol and Tobacco Use</td><td colspan="2">• Alcohol and tobacco use should be avoided during pregnancy.</td></tr>
</table>

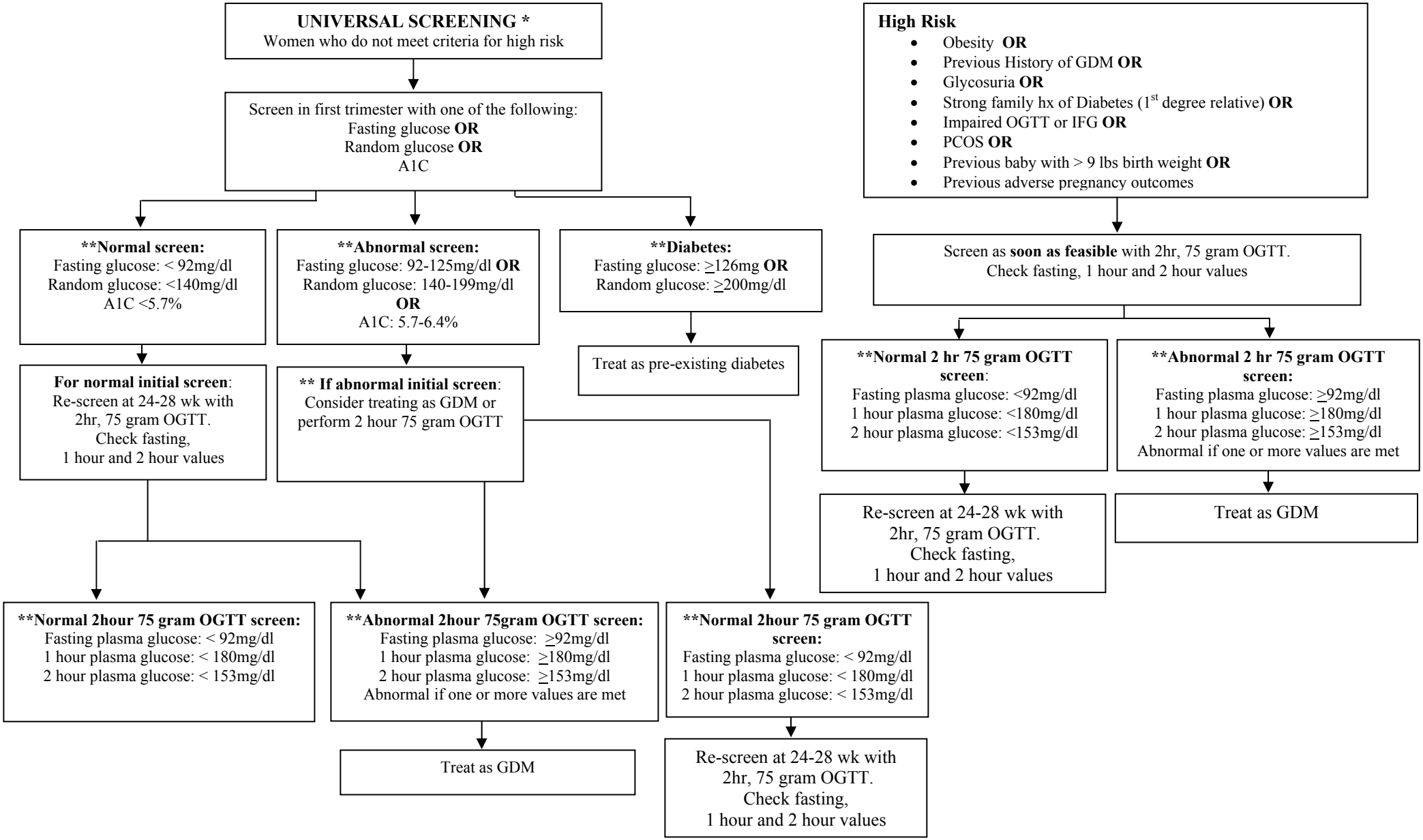
POST-PARTUM CARE

- Breastfeeding is encouraged in patients with pre-existing or gestational diabetes
- Enalapril and captopril may be used to treat hypertension and albuminuria in nursing mothers of full-term infants
- Appointments with the following specialists should be completed 6-8 weeks post-partum: ophthalmology, RD or RN and endocrinology.
- For women who develop GDM:
  - A 2-hour 75 g OGTT should be checked at 6 weeks to evaluate for persistent diabetes
    - Normal: fasting glucose level <100mg/dl
    - Impaired fasting glucose: fasting glucose level 100-125mg/dl
    - Diabetes: fasting glucose level ≥126mg/dl
    - Impaired glucose tolerance: 2 hr OGTT value 140-199mg/dl
    - Diabetes: 2 hr OGTT value ≥ 200mg/dl
  - Counsel women with GDM on the role of lifestyle management and weight loss to reduce the risk of future type 2 DM (of note: approximately 50% of women with GDM will develop overt type 2 diabetes in the next 7 to 10 years)
  - Review nutrition guidelines and establish exercise goals. For women with BMI greater than 25 (this may be lower in Asians) target a 5-7% weight loss from the preconception weight.
- Discuss family planning/contraceptive issues. Depo-Provera and progestin-only oral contraceptives are less preferred in patients who have had gestational diabetes, as they can accelerate the development of type 2 diabetes. In patients with pre-existing diabetes, Depo-Provera may worsen glycemic control. The intrauterine device (IUD) is preferred in monogamous partnerships because it is a metabolically neutral and highly effective form of contraception.
- Assist women with gestational diabetes with the transfer of care back to the primary care physician for longer term diabetes screening (including yearly fasting glucose, 1 year post partum and every 3 years afterwards 75 gram 2hour OGTT), risk reduction and for lifestyle management.

Gestational Diabetes Mellitus

Screening Strategy to Detect GDM

Risk assessment should be done at first prenatal visit



**Plasma values, based on International Association of Diabetes and Pregnancy Study Groups Consensus Panel (IADPSG)

Glossary

Hadlock AC: formula to identify macrosomia establisbed by Hadlock et al

ACE Inhibitor: angiotensin converting enzyme inhibitor

ARBs: angiotensin receptor blockers

BMI: body mass index

CAD: coronary artery disease

CDE: Certified Diabetes Educator

DE: diabetes educator; nurse or dietitian with advanced education in diabetes management

GDM: gestational diabetes mellitus

IFG: impaired fasting glucose

IGF: receptor: Insulin-like growth factor receptor

IOM: Institute of Medicine

MDI: multiple daily injections

MNT: Medical Nutrition Therapy

OGTT: oral glucose tolerance test

PCOS: polycystic ovarian syndrome

SMBG: self-monitoring of blood glucose

TSH: thyroid stimulating hormone

WHO: World Health Organization

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Approved by Joslin Clinical Oversight Committee on 09/10/2010

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