

**Obstetric Guideline 10B**  
**DIABETES MELLITUS AND PREGNANCY TYPE 1& 2**

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***DEFINITION***

Diabetes mellitus is a syndrome characterized by hyperglycemia and disturbances of carbohydrate, fat, and protein metabolism associated with absolute or relative deficiencies in insulin secretion and/or insulin action.<sup>1</sup>

***RELEVANCE***<sup>2-6</sup>

Preexisting diabetes mellitus is associated with an increase in maternal morbidity, congenital malformations, intrauterine fetal death and neonatal morbidity and mortality. These complications are directly related to an abnormal maternal metabolic environment.

Note: Blood glucose control during pregnancy needs to be particularly strict to minimize fetal and/or newborn complications.<sup>7,8</sup>

**I. MATERNAL RISKS<sup>9</sup>**

- Pregnancy induced hypertension
- Polyhydramnios
- Diabetic ketoacidosis
- Infection
- Hypoglycemia
- Presence of micorvascular disease
  - Retinopathy
  - Nephropathy
  - Neuropathy
- Presence of macrovascular disease
- Operative delivery secondary to fetal macrosomia
- Intrapartum trauma secondary to fetal macrosomia

**II. FETAL/NEONATAL RISKS**

- Congenital anomalies
- Macrosomia
- Birth trauma secondary to macrosomia<sup>10</sup>
- Intrauterine death
- Respiratory Distress Syndrome (RDS)
- Intrauterine Growth Restriction (IUGR)
- Hypoglycemia
- Polycythemia
- Hyperbilirubinemia

- Hypocalcemia

### **INCIDENCE**

Type 1: 0.5-1.2% of pregnancies

Type 2: incidence is rapidly increasing

### **PREVENTIVE MEASURES TO DECREASE RISK**

The primary goal is to establish normoglycemia prior to conception and maintain it during fetal organogenesis and throughout gestation. This is accomplished through:

- Preconception counseling and risk evaluation
- Strict metabolic control (normoglycemia)
- Ongoing education and support through an integrated, multidisciplinary team approach. An integrated team consists of a family physician, obstetrician, internist/endocrinologist, diabetes nurse educator, dietitian, physiotherapist, social worker, neonatologist, and/or pediatrician
- Health care providers may consult an appropriate diabetic team at a secondary or tertiary institution.

### **PRECONCEPTION MANAGEMENT<sup>11</sup>**

Counseling women with diabetes who plan to conceive is the single most important intervention now available to reduce the likelihood of spontaneous abortion and birth defects.<sup>12</sup> It may take up to 6 months or more to achieve optimal blood glucose control *and* an optimal HbA<sub>1C</sub>, therefore it is necessary to continue contraception until control is achieved.

#### **I. ASSESSMENT**

##### **A. History**

- General health, obstetrical and gynecological
- Medications, smoking/alcohol/drug use
- Activity
- Diet

##### **B. Physical**

- Assessment of the woman's diabetes status in terms of glucose control
  - past history of glucose control, severe hypoglycemic reactions
  - current self blood glucose monitoring schedule and blood glucose ranges
  - current insulin regimen
- Assessment of presence or absence of end organ damage<sup>13</sup>
  - degree of retinopathy (ophthalmology assessment)

- nephropathy (24 hour protein excretion or microalbumin/creatinine ratio, and serum creatinine as needed)
- peripheral and autonomic neuropathy
- coronary artery and cerebral vascular disease
- peripheral vascular disease

**C. Laboratory**

- HbA<sub>1C</sub>
- Urine for ketones
- Urine for culture if needed

**D. Genetic Counseling** : may be offered if other risk factors (e.g. advanced maternal age) are present.

**II. CARE PLAN**

**A. Counseling**

- See woman and partner together whenever possible
- Present current facts regarding management and outcomes of diabetes in pregnancy
- Allow time for questions and discussion
- Refer to appropriate professionals for assessment

**B. Nutrition** (See Appendix I: Nutritional Management for Diabetes Mellitus & Pregnancy)

**C. Activity** (See Appendix II: Exercise Management for Diabetes Mellitus during Pregnancy)

**D. Psychosocial** (See Appendix III: Psychosocial Management for Diabetes Mellitus during Pregnancy)

**E. Education and Monitoring**

- Discuss the role of glycemic control in prevention of congenital defects<sup>14</sup>
- Provide information about changing needs during pregnancy
- Provide instruction regarding intensive regulation of blood glucose
- Review blood glucose testing schedules and check accuracy of technique
- Check accuracy of blood glucose testing meter
- Review technique of urine ketone testing
- Provide information on diabetic ketoacidosis and starvation ketosis
- Discuss need for frequent contact with the diabetes team
- Discuss the importance of relationship of diet, activity, and insulin in overall diabetes management, and provide assistance in balancing these.

## **F. Insulin Use**

Discuss/review the following:

- Discontinuation of oral hypoglycemics if in use
- Preparation and injection of insulin (all Type 1, Type 2 when on insulin)
- Type, timing, and action of insulin
- Frequent (often daily) contact with diabetes team for insulin adjustment
- Hyperglycemia: symptoms/signs of and treatment
- Hypoglycemia: symptoms/signs of and treatment
- Importance of following the diet and activity plan

## **ANTEPARTUM MANAGEMENT<sup>15</sup>**

### **AIM: Euglycemia**

#### **I. ASSESSMENT**

If the woman has not been assessed preconception, include preconception assessment information in addition to:

##### **A. Obstetrical**

- Determine accuracy of gestational age – may benefit from early dating by ultrasound
- Assess present glucose control
- Laboratory Investigations
  - HbA<sub>1C</sub>
  - CBC
  - serum alphafetoprotein at 16 – 18 weeks
- Ultrasound
  - at 18-20 weeks for assessment of gestational age and congenital anomalies, include fetal cardiac scan
  - repeat as needed for suspected macrosomia/polyhydramnios/IUGR
  - amniocentesis and genetic counseling as needed (e.g. if maternal serum triple screen abnormal or ultrasound shows fetal anomaly)
  - ongoing surveillance for maternal/fetal complications
  - weekly fetal non stress test  $\geq$  34 weeks

#### **II. CARE PLAN**

##### **A. Counseling**

- Provide supportive environment
- Educate as necessary regarding diabetes and pregnancy
- Review the woman's own responsibilities

- Review surveillance during pregnancy
- Address gaps in knowledge
- Refer to appropriate professionals

**B. Nutrition** (See Appendix I: Nutritional Management for Diabetes Mellitus & Pregnancy)

**C. Activity** (See Appendix II: Exercise Management for Diabetes Mellitus during Pregnancy)

**D. Psychosocial** (See Appendix III: Psychosocial Management for Diabetes Mellitus during Pregnancy)

**E. Monitoring**

1) Blood Glucose: Scheduling

- ac breakfast, ac lunch, ac supper, ac hs snack daily
- Monitor ac all meals, 1 hour pc all meals, and ac hs snack (7 tests/day) once or twice per week

2) Blood Glucose: Education

- technique of capillary blood glucose testing
- **target values:** Type 1: 4-6 mmol/L ac meals  
Type 2: 5 or less mmol/L ac meals } with minimal hypoglycemia
- interpretation of values
- record keeping
- communication (phone calls, visits)
- treatment of hypoglycemia

3) Ketones (urine): Scheduling

- ac breakfast, ac supper daily
- if glucose values high
- if sick (in addition to above)
- if ketonuria (test all voiding until clear)

4) Ketones: Education

- significance and management of ketonuria
- technique and recording
- when to contact team

**F. Insulin Use**

1) **Scheduling**

Achieving rigorous control usually requires at least two insulin injections per day. The most frequently seen schedules are on the following page:

<b>ac Breakfast</b>	<b>ac Supper</b>
NPH / Regular or Humalog ®	NPH / Regular or Humalog ®

or

<b>ac Breakfast</b>	<b>ac Supper</b>	<b>hs</b>
NPH / Regular or Humalog ®	Regular or Humalog ®	NPH or Ultralente

or

<b>ac Breakfast</b>	<b>ac Lunch</b>	<b>ac Supper</b>	<b>hs</b>
Regular or Humalog ®	Regular or Humalog ®	Regular or Humalog ®	NPH or Ultralente

The choice of insulin regimen is based on achieving acceptable control with minimal hypoglycemia e.g. if nocturnal hypoglycemia occurs with NPH taken ac supper, the NPH may be moved to hs.

2) **Principles of Management:**<sup>16,17</sup>

- Assessment of blood glucose levels for:
  - a) effect of diet and activity
  - b) insulin adjustment (frequent changes are often necessary due to changing needs in pregnancy)
- Assessment for the presence of macrosomia and/or polyhydramnios
- Patient education as outlined under Preconception Care Plan (page 3)
- Occasionally hospitalization is needed for closer surveillance and more extensive teaching and support when effective blood glucose control cannot be achieved on an outpatient basis (e.g. language/literacy barriers, noncompliance)

**INTRAPARTUM MANAGEMENT**

**I. ASSESSMENT**

The time and type of delivery is dependent upon the assessment of the mother and fetus, and must be individualized for each woman. Ideally, await spontaneous onset of labour between 37-38 weeks, unless maternal and/or fetal reasons arise which necessitate delivery.<sup>18</sup>

The vast majority of women with Types 1 or 2 diabetes are delivered prior to their EDC.<sup>19</sup>

Whether labour is spontaneous or delivery is planned, assessment components to consider include:

- Gestational age
- Fetal lung maturity
- Presence of maternal complications
- Fetal well being
  - non stress test (NST)
  - fetal movement counts
  - biophysical profiles
  - umbilical flow Doppler
- Fetal macrosomia, polyhydramnios, IUGR, previous stillbirth
- Metabolic control

**II. MANAGEMENT**

**A. Spontaneous Labour**

- Baseline glucose and urine ketones upon admission
- Monitor blood glucose q2h in early labour, q1h in active labour until delivery
- Administer glucose containing solution, i.e., D<sub>5</sub>S/D<sub>5</sub>W @ 125 cc/hr
- If blood sugar > 8.0 mmol/L, administer insulin via sliding scale as per physician's order, e.g.

<b>Blood Glucose</b>	<b>Insulin</b>
8.1 – 11.0 mmol/L	1 – 2 units Regular insulin
11.1 – 13.0 mmol/L	2 – 3 units Regular insulin
> 13.0 mmol/L	3 – 5 units Regular insulin (call doctor)

- Check each voiding for ketones (catheter specimen to be obtained only when glycemic control is difficult)
- If significant ketonuria, notify physician since additional insulin is likely needed, and change IV to D<sub>10</sub>W @ 125 cc/hr until ketones clear

- Woman in early labour may have light diet or oral fluids until in the active phase

## **B. Induction of Labour**

### 1) Prior to day of induction:

- Usual insulin dose and meal plan to maintain euglycemia

### 2) Morning of induction:

Consider method of induction. For those women having prostaglandin gel insertion, continue with the usual diabetes regimen until labour starts, and then continue management as for spontaneous labour.

For those women undergoing oxytocin induction, manage as follows:

- Baseline blood glucose on admission
- Obstetrical orders for diet: NPO/clear fluids/easy to digest foods and fluids (See Appendix I: Nutritional Management for Diabetes Mellitus & Pregnancy)
- Withhold insulin if fasting
- Ac breakfast insulin orders are given on an individual basis
- Continue as for management of spontaneous labour

## **C. Caesarean Delivery**

- NPO from midnight (large snack and water prior to this)
- Withhold insulin in AM
- Monitor blood glucose and urine ketones q4h until delivery
- IV D<sub>5</sub>W @ 125 ml/hr until surgery and change to D<sub>10</sub>W @ 125 ml/hr until clear if ketonuria or hypoglycemia
- Anaesthesiologist to manage IV fluids during surgery

## **D. Immediate Post Partum Period**

- Test blood glucose soon after delivery
- Test q1-2 hr during recovery period
- Do not transfer from LDR/PAR until blood glucose levels are acceptable and ketones clear
- Follow physician's orders for diet and insulin during immediate postpartum period.
- Insulin requirements drop significantly following delivery. Regular insulin is usually given on sliding scale as per physician's order on an individual basis, according to blood glucose.

## **POSTPARTUM MANAGEMENT**

### **I. MANAGEMENT**

- Blood glucose monitoring schedule as per physician's order
- Establish diet for home use (See Appendix I: Nutritional Management for Diabetes Mellitus & Pregnancy)
- Establish activity pattern for home use (See Appendix II: Exercise Management for Diabetes Mellitus during Pregnancy)
- There is a gradual transition from sliding scale insulin to establishing a base dose. Women are encouraged to remain in phone contact with the diabetes team as needed after discharge home.

### **II. COUNSELING**

- Insulin adjustment for optimal blood glucose control
- Breast feeding
- Preconception counseling for future pregnancies
- Contraception
- Follow up with internist/endocrinologist/diabetes centre
- Community resources

## **INFANT CARE**

Refer to BCRCP Newborn Guideline #5, Infants of Diabetic Mothers (IDM)

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## APPENDIX I

### NUTRITIONAL MANAGEMENT FOR DIABETES MELLITUS AND PREGNANCY

Health care providers may consult with a dietitian at a secondary or tertiary institution.

#### ***PRECONCEPTION***

- Encourage the achievement of maintenance of a healthy weight for height.
- Encourage a nutritionally adequate diet which is compatible with insulin regimen, lifestyle, and aids in the achievement of optimal blood glucose control.
- Supplement with folic acid 1.0-4.0 mg after discontinuation of reliable birth control until 12 weeks after LMP<sup>1</sup> (see Obstetric Guideline 9: Folic Acid and the Prevention of Neural Tube Defects).

#### ***DURING PREGNANCY***

- If the woman was not seen preconception, refer to registered dietitian for assessment and provision of individualized meal plan.
- If the woman was seen preconception then update the preconception meal plan for pregnancy requirements.
- Supplement with folic acid 1.0-4.0 mg after discontinuation of reliable birth control until 12 weeks after LMP<sup>1</sup> (see Obstetric Guideline 9: Folic Acid and the Prevention of Neural Tube Defects).
- Meal plan adjustment is based on blood glucose, ketones, hunger, weight gain, insulin regimen, activity, and patient preference.
- Characteristics of individualized meal plan:
  - nutritionally adequate by meeting Canada's Food Guide to Healthy Eating for Pregnancy
  - timing and content of meals and snacks are tailored to individual's lifestyle, activity, and insulin regimen. Food is usually distributed over 3 meals and 1 or more snacks.
  - adequate in energy to promote normal weight gain and prevent ketonuria and hunger. Bedtime snack must be sufficient to prevent nocturnal hypoglycemia and/or morning ketonuria.
  - low in sugars and juices
  - adequate fluid intake (minimum 6-8 cups of fluid daily)
- Use of sweeteners:
  - Aspartame, Sucralose, and Acesulfame-Potassium may be used in moderation (3-4 choices per day)
  - Cyclamate and saccharin should be avoided
  - Inclusion of nutritive sweeteners (e.g. sorbitol, sucrose, and fructose) is based on blood glucose control

- Breastfeeding is encouraged for infant feeding

### ***INTRAPARTUM***

- If able to eat according to meal plan in early labour, a woman may do so. If unable to eat according to the regular meal plan, she may switch to easy to digest foods/fluids to maintain her energy and hydration. For example:
  - one choice every hour of ½ cup regular pop, juice, or jello, ½ popsicle, 1 cup soup, 1 slice toast, 2 plain cookies, 6 crackers
  - encourage fluids such as 1 cup water or soup every hour

### ***POSTPARTUM***

- Refer to registered dietitian for assessment of an individualized meal plan based on mode of infant feeding (see below)
- Continue to place emphasis on the importance of a regular pattern of meals and snacks to achieve optimal blood glucose control through insulin adjustment
- Encourage achievement of healthy weight for height through healthy eating and regular exercise as a long term goal.

#### **I. BREASTFEEDING**

- Encourage breastfeeding and healthy eating for breastfeeding
- Ensure adequate calories at meals and snacks; need for additional calories assessed on an individual bases
- Discuss tips to prevent hypoglycemia

#### **II. BOTTLEFEEDING**

- Reduce calories to maintenance levels for the first 6 weeks postpartum
- Reassess energy needs as calories may need to be further decreased to promote gradual weight reduction.

### ***REFERENCE***

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## **APPENDIX II**

### **ACTIVITY/EXERCISE MANAGEMENT FOR DIABETES MELLITUS DURING PREGNANCY (TYPE 1, TYPE 2, GESTATIONAL DIABETES)**

An interdisciplinary team approach is needed to integrate activity/exercise goals with the overall management and education plan. It is necessary to provide recommendations for individualized activity. Any contraindications or limitations for exercising should be assessed. Assessment includes:

1. Metabolic
  - hypoglycemia
  - hyperglycemia with ketonuria
2. Physical
  - musculoskeletal and respiratory
  - medical history
  - activity/exercise history: include lifestyle, ability, tolerance, and commitment
3. Obstetrical limitations (as per physician assessment)
  - ruptured membranes
  - antepartum hemorrhage
  - irritable uterus, preterm labour
  - incompetent cervix
  - hypertension
  - any other condition requiring decreased activity
4. Precautional limitations
  - vascular disease, ischemic heart disease
  - nephropathy
  - proliferative retinopathy
  - neuropathy
5. Understanding of the benefits of activity/activity during pregnancy.

### ***ANTEPARTUM***

#### **I. ACTIVITY MANAGEMENT: NO COMPLICATIONS**

##### **A. Assessment**

- 1) Metabolic control at the onset of exercise
- 2) Timing of meals, exercise type and timing in relation to food and insulin injections
- 3) Site of insulin injections in relation to type of activity
- 4) Effect of exercise, of diet, of insulin

## **B. Patient Education**

- 1) Activity is individualized and reevaluated periodically according to obstetrical status and gestational age: consistency in type, scheduling, duration and intensity of activity is stressed. Activities may include:
  - brisk walks for 20-30 minutes
  - stationary exercise bike for 10-15 minutes
  - upper body exercise
  - housework
  - stairs for 10 minutes in absence of back pain
  - exercise video for pregnancy
- 2) Teach proper foot care and use of supportive shoes for exercise.
- 3) Carry identification.
- 4) Keep a log book recording blood sugars, diet, activity, and insulin
- 5) Previously active women may continue with their pre-pregnancy exercise *as tolerated*
- 6) Nutrition (refer to Appendix I: Nutritional Management for Diabetes Mellitus and Pregnancy)
- 7) Insulin Teaching includes:
  - proper site selection dependent on exercise type and duration
  - importance of adhering to diet and activity plan
  - need to carry fruit or juice to counteract hypoglycemia
  - possible use of small snacks, dependent on time and intensity of exercise
  - monitor glucose level response to exercise daily
  - monitoring for late hypoglycemia (can occur several hours after exercise) which may indicate need for diet/insulin changes in post-exercise period

## **C. Scheduling**

- 1) Exercise type can be varied, but **not the time** of exercise to avoid exercise at the peak of insulin activity
- 2) Exercise immediately (i.e. within 5 to 10 minutes) after meals
- 3) Avoid exercise immediately before the next meal

## **D. Record Keeping**

- 1) Activity chart is necessary to assist the woman and the team in assessing the type and amount of exercise in relation to blood glucose levels
- 2) Record **any** increase in uterine activity
- 3) Monitoring responses to specific exercise routines is helpful for future guidelines

## **II. ACTIVITY MANAGEMENT: OBSTETRICAL COMPLICATIONS**

### **A. Assessment**

- 1) Physician assessment of contraindications/limitations

**B. Appropriate Exercises**

- 1) Relaxation techniques
- 2) Basic arm, leg, and neck range of motion exercises as tolerated, to be done immediately after meals
- 3) If pregnancy complications arise, ensure mother is aware of:
  - any warning signs
  - activity limitations

**III. ACTIVITY MANAGEMENT: MUSCULOSKELETAL COMPLICATIONS**

**A. Assessment**

- Physiotherapy assessment to determine extent of discomfort and dysfunction

**B. Management: Activity Plan**

- Pain management education and techniques
- Body mechanics, posture, gait correction
- Resting positions
- Use of pelvic supports (if appropriate)
- Appropriate exercise/stretching
- Muscle energy techniques, myofascial release
- Re-evaluation to determine changes to activity level

***POSTPARTUM***

- Establish activity pattern for home use with daily monitoring until insulin requirements return to pre-pregnant levels
- Review possible options for an ongoing, long term, enjoyable activity/exercise program
- Discuss benefits of regular exercise and lifestyle changes

### **APPENDIX III**

## **PSYCHOSOCIAL MANAGEMENT FOR DIABETES MELLITUS DURING PREGNANCY**

### ***RISK FACTORS***

It may be necessary to provide in-depth psychosocial assessment and care to pregnant women with diabetes mellitus. The social worker will be able to access the appropriate services needed. The risk factors for referral include the following:

- Adolescent (age 19 and under)
- Fetal/newborn anomalies
- History of previous losses
- Early Pregnancy or perinatal loss
- Adjustment to diabetes complications and management during pregnancy
- Adjustment to pregnancy, concerns regarding emotional responses
- Adjustment to hospitalization
- Psychiatric history
- Bonding difficulties with newborn
- Need for parenting skills
- Isolation/limited supports
- Relationship/family stresses
- Immigration/refugee concerns
- Mentally/physically disadvantaged
- Multiple birth

### ***MANAGEMENT***

A multi-disciplinary team approach is necessary to formulate a care plan to enhance adjustment to lifestyle changes with diabetes and pregnancy. A care plan may include:

- Psychosocial assessment
- Child protection assessment and intervention
- Specialized counseling for crisis intervention, adjustment, substance dependency, adoption, and grief
- Resource counseling e.g. handouts, support groups
- Practical support and assistance
  - diabetic supplies
  - financial concerns, accommodation, transportation
  - interpretation service
  - baby supplies, childcare/homemaker help
  - petty cash vouchers for food, personal comforts
  - nursing bra vouchers
- Liaison with appropriate community agencies for community support and follow-up.