

## > Statement of Objectives

After reading this lesson you will be able to:

1. identify patients at risk for Type 2 diabetes and recommend appropriate screening.
2. discuss causes of diabetes with patients and raise awareness of personal risk for the disease.
3. recommend appropriate non-pharmacological and pharmacological treatment options for patients with diabetes.
4. recommend and implement appropriate blood glucose, lifestyle and diabetes complications monitoring strategies.
5. implement approaches to narrow many of the current diabetes care gaps through improved knowledge and use of diabetes care tools.



## DIABETES CARE - MANAGEMENT TOOLS AND GUIDELINES FOR PHARMACIST TREATMENT RECOMMENDATIONS

by Tom Smiley, BSc Phm, Pharm D

## > Instructions

1. After carefully reading this lesson, study each question and select the one answer you believe to be correct. Circle the appropriate letter on the attached reply card.
2. Complete the card and mail, or fax to (416) 764-3937.
3. Your reply card will be marked and you will be advised of your results in a letter from Rogers Publishing.
4. To pass this lesson, a grade of 70% (14 out of 20) is required. If you pass, your CEU(s) will be recorded with the relevant provincial authority(ies). (Note: some provinces require individual pharmacists to notify them.)

## > Disclosure

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### INTRODUCTION

THE PREVALENCE OF DIABETES IN CANADA IS currently estimated at greater than 7%.<sup>1</sup> Researchers have predicted that current Canadian demographic and population lifestyle trends will result in diabetes becoming the public health crisis of the 21<sup>st</sup> century.<sup>1</sup> Canada's aging population, increased immigration from high-risk populations, and growth in the Aboriginal population all contribute to increasing risk for rising diabetes prevalence. Alarming rates of childhood obesity and sedentary lifestyle also support the dire prediction.<sup>1</sup>

Care gaps exist in the screening and management of diabetes. It is estimated that one of three Canadians afflicted with diabetes are not aware of their condition. Furthermore, therapeutic targets for blood glucose, blood pressure, lipids and body mass index (BMI) values can be very challenging to attain for patients with diabetes. The goal of this lesson is to equip pharmacists with knowledge and tools necessary to narrow the diabetes care gaps in an environment of integrated community care.

### UNDERSTANDING RISK FACTORS FOR DIABETES

A CLEAR UNDERSTANDING OF THE PATHOGENESIS of Type 1 and Type 2 diabetes, as well as associated risk factors will help your patients appreciate the rationale behind diabetes prevention and management strategies.

### Pathogenesis of Diabetes

Approximately 10% of all people with diabetes have Type 1 diabetes. This form of the disease (previously referred to as juvenile diabetes) is associated with pancreatic beta cell destruction caused by an autoimmune process, or a secondary process where the cause of beta cell destruction is unknown. Patients with Type 1 diabetes are generally diagnosed at a younger age than Type 2 diabetes and always require insulin therapy.

The etiology of Type 2 diabetes is more complex. The pathway to Type 2 diabetes most often begins with a reduction of the sensitivity of tissue to the effects of insulin. Loss of insulin sensitivity is most often a result of lifestyle issues that lead to obesity. Together these factors promote a phenomenon known as the "metabolic syndrome" (see next section). Beta cells of the pancreas are forced to produce more insulin in an effort to overcome the insulin resistant state and prevent blood glucose from rising to a level where the person would be deemed to have Type 2 diabetes (see Table 5). Many people in these circumstances continue to produce sufficient insulin, and escape the Type 2 diabetes diagnosis. In those who go on to develop Type 2 diabetes, the beta cells of the pancreas are eventually compromised by a process that has not yet been fully elucidated.

Some have called it beta cell “exhaustion,” others refer to a state of “glucose toxicity.”<sup>2</sup> Approximately 25% of the adult North American population is insulin-resistant, while approximately 7.5% have Type 2 diabetes. The balance of the insulin-resistant population is often in a “pre-diabetes” state with fasting plasma glucose levels between 6.1 and 7.0 mmol/L. It is likely that inherited factors play a role in determining the risk for people in the insulin-resistant state progressing to Type 2 diabetes.

### The Role of the Metabolic Syndrome

The insulin-resistant state that promotes increasing plasma insulin and glucose levels is also associated with a combination of metabolic abnormalities that increase the risk for coronary artery disease (CAD). Metabolic syndrome is the term that has been given to this phenomenon. It has been defined by the National Cholesterol Education program ATP III criteria as a combination of any 3 of the following risk factors:

- Fasting plasma glucose 6.1 mmol/L
- Blood pressure 130/85 mm Hg
- Triglycerides 1.7 mmol/L
- HDL cholesterol <1.0 mmol/L (men) or <1.3 mmol/L (women)
- Abdominal obesity — waist circumference >102 cm (men), or >88 cm (women)

The metabolic syndrome also promotes the production of small, dense LDL cholesterol particles which are more easily oxidized and incorporated into arterial endothelium than normal LDL cholesterol.<sup>3</sup> In addition, the metabolic syndrome is associated with increased levels of plasminogen activator inhibitor (PAI-I), resulting in blood that is hyper-

**TABLE 1** Risk Factors for Diabetes<sup>20</sup>

If you check any of the following boxes you should be tested for diabetes earlier and/or more often.

- I have a parent, brother or sister with diabetes.
- I am a member of a high-risk population group (e.g., Aboriginal, Hispanic, Asian, south Asian or African descent).
- I have health complications that are associated with diabetes (e.g., heart disease, kidney disease, eye disease, nerve damage, problems with erection [impotence]).
- I gave birth to a baby that weighed more than 4 kg (9 lb.) at birth.
- I had diabetes during my pregnancy (known as gestational diabetes).
- I have high blood pressure.
- I have high cholesterol or other fats in my blood.
- I am overweight (especially if most of your weight is around your middle).
- I have been diagnosed with schizophrenia, acanthosis nigricans (darkened patches of the skin) or polycystic ovary syndrome.

\*A similar patient-friendly table can be downloaded from the Canadian Diabetes Association website at [http://www.diabetes.ca/Section\\_about/atrisk.asp](http://www.diabetes.ca/Section_about/atrisk.asp)

**TABLE 2** Health Risks Associated with BMI Category

Classification	BMI category (kg/m <sup>2</sup> )	Risk of Developing Health Problems
Underweight	<18.5	Increased
Normal Weight	18.5-24.9	Least
Overweight	25.0-29.9	Increased
Obese		
Class I	30.0-34.9	High
Class II	35.0-39.9	Very High
Class III	≥40.0	Extremely High

Canadian Guidelines for Body Weight Classification in Adults available at: [http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/qa\\_public\\_e.html](http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/qa_public_e.html)

coagulable.<sup>3</sup> Taken together, the risk factors of the metabolic syndrome significantly increase risk for atherosclerosis and CAD. One can appreciate from this discussion why patients with Type 2 diabetes are automatically considered to be at the highest level of risk for heart disease (2 to 4 times the risk of the general population).

### Managing Lifestyle Risk Factors for Type 2 Diabetes

Table 1 may be used to help identify those patients who should have their blood glucose tested more frequently and/or more often. From the previous discussion it should come as no surprise that elements of the metabolic syndrome (abdominal obesity, dyslipidemia, hyper-

## FACULTY

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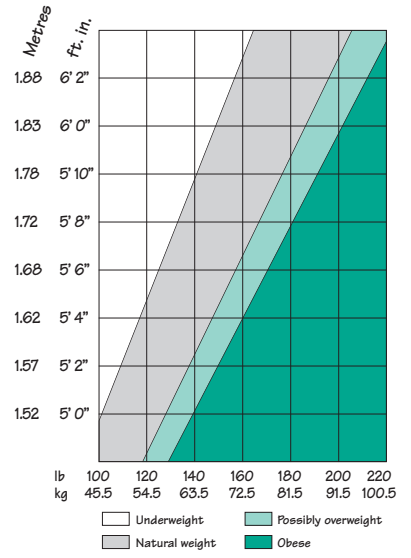


**TABLE 3** Criteria for Diagnosis of Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT)

	Fasting Plasma Glucose (FPG)	2-Hour Plasma Glucose in a 75 g Oral Glucose Tolerance Test (OGTT)
IFG	6.1-6.9 mmol/L	NA
IFG (isolated)	6.1-6.9 mmol/L	<7.8 mmol/L
IGT (isolated)	<6.1 mmol/L	7.8-11.0 mmol/L
IFG and IGT	6.1-6.9 mmol/L	7.8-11.0 mmol/L

**FIGURE 1** BMI Nomogram

To find your BMI range first find your height in metres (or in feet and inches), then run your finger across until it meets the vertical line representing your weight.



tension) are considered risk factors for Type 2 diabetes. Managing lifestyle issues will reduce cardiovascular disease risk as well as promote blood glucose control.

*Weight Management*

Abdominal obesity is a key driver of insulin resistance, the metabolic syndrome and therefore risk for Type 2 diabetes.

- The BMI is the accepted method for classifying health risk attributed to body weight in Canada. Figure 1 will allow your patients to determine their BMI easily, while Table 2 will help them make the link between BMI and associated health risks. The information contained in Figure 1 and Table 2 can be downloaded from the Health Canada website online at [http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/bmi\\_chart\\_java\\_e](http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/bmi_chart_java_e).
- Weight loss of 5 to 10% is associated with substantial improvement in insulin sensitivity, and subsequently for blood glucose, high blood pressure and dyslipidemia management.<sup>4</sup>
- The 2003 Canadian Diabetes Association guidelines recommend a moderate but consistent rate of weight loss of 1 to 2 kg (2 to 4 lb.) per month.<sup>4</sup> In order to achieve this, a negative energy balance of 500 calories per day (i.e., 500 more calories per day expended than taken in through diet) is required. All diets should be well-balanced and nutritionally adequate (see section on diet and nutrition).
- Anti-obesity pharmacological agents are indicated for management of obesity when lifestyle measures fail to achieve desired weight loss after an adequate trial of 3 to 6 months.<sup>4</sup> Orlistat and sibutramine are indicated in Canada for long-term management of obesity. Both have indications which include management of BMI of 30 kg/m<sup>2</sup> or greater, or 27 kg/m<sup>2</sup> or greater, when obesity-related comorbidities or risk factors exist.<sup>4</sup>

*Physical Activity*

The 2003 Canadian Diabetes Association guidelines recommend the following physical activity strategies for management of diabetes.<sup>5</sup>

- Accumulation of at least 150 minutes of moderate-intensity aerobic exercise (e.g., brisk walking, biking, continuous swimming that allows a person to reach 50 to 70% of their maximum heart rate) each week spread over at least 3 nonconsecutive days of the week, or 4 or more hours of exercise per week.
- Resistance exercise (e.g., weight lifting, exercise with weight machines) 3 times per week should be encouraged.
- Patients with medical conditions that might be adversely affected by overexertion should talk with their doctor before beginning an exercise program.
- Patients may also be referred to [www.paguide.com](http://www.paguide.com). This is an excellent resource for determining exercise routines most suited to an individual's needs and likes.

*Diet and Nutrition*

The 2003 Canadian Diabetes Association guidelines recommend consultation with a registered dietitian and the following nutritional strategies for management of diabetes.<sup>6</sup>

- Partake of a variety of foods.
- Emphasize cereals, breads and other whole grain products, fruits and vegetables.
- Choose lower-fat dairy products, leaner meats and food prepared with little or no fat.
- Limit sodium, alcohol and caffeine.
- Dietary energy intake should consist of:
  - 50 to 55% of daily calories as carbohydrates with a focus on low-glycemic index foods (e.g., grains, fruits) in place of high-glycemic-index foods (e.g., white bread, instant rice)
  - 15 to 20% of daily calories as protein
  - Less than 30% daily calories as fat,

- with less than 10% of daily calories as saturated fats and trans-fatty acids.
- Note: A balanced diet that is consistent with appropriate energy intake as discussed with a dietitian or diabetes educator is what is important here. "Fad diets" promoting high levels of particular food groups and low levels of others are therefore not recommended for people with diabetes.
- Many recommendations and helpful guides (including an explanation of the glycemic index) can be found on the Canadian Diabetes Association website at [www.diabetes.ca/Section\\_About/NutritionIndex.asp](http://www.diabetes.ca/Section_About/NutritionIndex.asp).

*Preventing Type 2 Diabetes Through Lifestyle Modification — Convincing Evidence*

Two large randomized controlled trials (the Diabetes Prevention Program and the Finnish Diabetes Prevention Study) included a large number of patients in a "prediabetes" state (i.e., impaired fasting glucose or impaired glucose tolerance.) (See Table 3.) Those partaking of a low-calorie diet with reduced fat intake and moderate-intensity physical activity of at least 150 minutes weekly, reduced risk for progression to diabetes compared to the control group of patients.<sup>7,8</sup> Compared to the control group, patients in the diet and exercise group reduced

their risk for diabetes by 58% at four years.<sup>7,8</sup>

## BLOOD GLUCOSE SCREENING AND DIAGNOSIS OF DIABETES

### Screening Guidelines

The 2003 CDA diabetes guidelines recommend screening for diabetes at an interval of every 3 years in individuals 40 years or older. A fasting plasma glucose (FPG) test is sufficient for general screening. More frequent and/or earlier testing should be considered in people with additional risk factors for diabetes. If FPG test results fall in the range of 5.7 to 6.9 mmol/L, and the patient has additional risk factors, then an oral glucose tolerance test should be conducted to determine their status as impaired fasting glucose, impaired glucose tolerance, or both (see Table 3).

### Diagnosis of Diabetes

Table 5 outlines the criteria for diagnosis of diabetes. It is especially important to note that when symptoms of diabetes (e.g., polyuria, polydipsia, unexplained weight loss) do not exist, results suggesting a diagnosis of diabetes must be confirmed on another day.<sup>9</sup>

### Blood Glucose Monitoring

Evidence has demonstrated that self-monitoring of blood glucose in association with appropriate response to results increases the likelihood of improved glycosylated hemoglobin (A1C) control and avoidance of hypoglycemia.<sup>10</sup> In addition, lifestyle flexibility is enhanced when dietary choices, physical activity and medications are adjusted in response to blood glucose measurement results. The pharmacy is an ideal environment for blood glucose self-monitoring education and follow-up. It is vital that all patients purchasing a meter be properly taught how to use it. This usually means arranging sufficient time by making an appointment with the patient. The technical aspects of using a blood glucose meter don't necessarily need to be taught by a pharmacist.

Frequency of blood glucose monitoring is determined on an individual basis. The following recommendations were proposed by the 2003 Canadian Diabetes Association guidelines.

- People with Type 1 diabetes should measure their blood glucose at least 3 times daily, and adjust their insulin require-

**TABLE 4** Signs and Symptoms of Diabetes<sup>20</sup>

- Unusual thirst
- Frequent urination
- Weight change (usually weight loss)
- Extreme fatigue or lack of energy
- Blurred vision
- Frequent or recurring infections
- Cuts and bruises that are slow to heal
- Tingling or numbness in hands or feet
- Trouble getting and maintaining an erection
- Increased hunger

**TABLE 5** Criteria for Diagnosis of Diabetes

**Fasting Plasma Glucose (FPG)**  
≥7.0 mmol/L

(Fasting = no caloric intake for at least eight hours), or

**Casual plasma glucose** ≥11.1 mmol/L +  
**symptoms of diabetes**

(Casual = any time of the day, without regard to the interval since the last meal)  
Classic symptoms of diabetes = polyuria, polydipsia and unexplained weight loss, or

**Plasma glucose two hours after ingestion of 75 g glucose** ) ≥11.1 mmol/L  
(i.e., oral glucose tolerance test or OGTT)

*Note: In the absence of unequivocal hyperglycemia accompanied by acute metabolic decompensation, for a diagnosis of diabetes to be confirmed, a laboratory glucose test (either FPG, casual PG or OGTT) must be performed on another day.*

ments according to their care plan.

- People with Type 2 diabetes who are treated with oral antihyperglycemic agents or basal insulin should measure their blood glucose at least once daily or more if behavioural (e.g., exercise) or treatment adjustments are required to achieve desired blood glucose levels.
- Blood glucose testing should include both before-meal and 2-hour after-meal testing. Readings should be recorded so that a "snapshot" of daily fluctuations in blood glucose reading can be captured over time. For example, Monday could be before breakfast, Tuesday before supper, Wednesday bedtime, Thursday after supper, Friday before breakfast, Saturday before supper, Sunday bedtime, and repeat.

- Meter results should be compared with laboratory measurement of simultaneous venous FPG at least annually, and when indicators of glycemic control do not match meter readings. A difference of less than 20% between simultaneous laboratory and glucose meter results is deemed acceptable.

Glycosylated hemoglobin (A1C) testing reflects glycemia over the 120-day lifespan of erythrocytes and allows for assessment of blood glucose control over that time period. An A1C test should be conducted every 3 months to ensure that treatment goals are being met.<sup>10</sup> See Table 6 for target A1C levels.

## DIABETES COMPLICATIONS - SCREENING AND STRATEGIES

**PATIENTS MUST UNDERSTAND THE CONSEQUENCES** of uncontrolled blood glucose. An informed patient is one who is more likely to be adherent to lifestyle and pharmacological treatment options.

The following are some of the consequences of chronically elevated blood glucose levels associated with diabetes (see Table 5). Patients must also understand that control of blood glucose will reduce risk for damage to the kidneys, eyes, and nerves (i.e., the microvasculature). Together with control of additional risk factors (e.g., blood pressure, cholesterol) blood glucose control can prevent or delay onset of these problems. In alphabetical order, interventions aimed at vascular protection (microvascular and macrovascular) include:

- Use of ACE Inhibitors as indicated
- Antiplatelet therapy (e.g., ASA) as indicated
- Blood pressure control
- Glycemic control
- Lifestyle modification
- Lipid control
- Smoking cessation
- **Nephropathy** — caused by damage to the blood vessels that filter waste from the blood and excrete it in the urine. Severe kidney damage can lead to kidney failure that may result in the need for dialysis or a kidney transplant.<sup>11</sup>
- Screening for diabetic nephropathy should be conducted on an annual basis using a random urine test for albumin to creatinine ratio (ACR). Any two abnormal ACRs out of three tests constitutes a diagnosis of diabetic nephropathy.

**TABLE 6** CDA 2003 Guidelines: Recommended Targets for Blood Glucose Control

	A1C (%)	FPG/preprandial PG (mmol/L)	2-hour postprandial PG (mmol/L)
Target for most patients	≤7.0	4.0-7.0	5.0-10.0
Normal range (consider as target for patient in whom it can be safely achieved)	≤6.0	4.0-6.0	5.0-8.0

**TABLE 7** Important Cardiovascular Targets for People with Diabetes

Blood pressure	<130/80 mm Hg
LDL Cholesterol	<2.5 mmol/L
Total Cholesterol/ HDL ratio	<4.0

- In people with Type 1 diabetes with albuminuria, an ACE Inhibitor should be prescribed to prevent progression of nephropathy.<sup>11</sup>
- In those with Type 2 diabetes with albuminuria, and creatinine clearance >60 ml/minute, an ACE inhibitor or an angiotensin receptor blocker (ARB) should be prescribed
- In those with Type 2 diabetes with albuminuria and creatinine clearance ≤60 ml/minute, an (ARB) should be prescribed
- Patients prescribed an ACE Inhibitor or an ARB should have serum creatinine and potassium levels checked within 2 weeks of initiation of therapy and periodically thereafter.
- Diltiazem or verapamil (i.e., the non-dihydropyridine calcium channel blockers) have been associated with a higher level of evidence than dihydropyridine calcium channel blockers (e.g., amlodipine, nifedipine) with respect to prevention of progression of nephropathy. Therefore they may be considered for reduction of urinary albumin excretion in hypertensive patients with protein in urine. Patients started on either of these drugs should be monitored for development of bradycardia.<sup>11</sup>
- **Retinopathy** — caused by damage to the blood vessels at the back of the eye. May be stopped by laser therapy if caught early enough and blood glucose kept under control.
  - In people with Type 1 diabetes older than 15 years, dilated eye exams should be performed once yearly starting 5 years after the onset of diabetes.<sup>12</sup>
  - In people with Type 2 diabetes, dilated eye exams should be performed at the time of diagnosis and at a minimum of every 1 to 2 years thereafter depending on clinical indication.<sup>12</sup>
  - Optimal blood glucose and lipid control are critical for prevention

and delay of progression of diabetic retinopathy.<sup>12</sup>

- **Neuropathy** — pain or numbness of feet, legs and hands (peripheral neuropathy) is the most common type of neuropathy. Nerves that control digestion and urination may also be damaged (autonomic neuropathy).
  - Screening for peripheral neuropathy should be conducted on a yearly basis by assessing loss of sensitivity to a 10-g monofilament at the great toe or loss of sensitivity to vibration at the great toe.<sup>13</sup>
  - Progression and onset of neuropathy is best treated with intensive glycemic control.
  - Pain of peripheral neuropathy may be treated with tricyclic antidepressants and/or anticonvulsant therapy where appropriate
- **Coronary artery disease (CAD)** — the metabolic syndrome puts people with Type 2 diabetes at 2 to 4 times greater risk for heart disease than the general population. CAD is a macrovascular complication.
  - Unless contraindicated, all people with diabetes should receive an ACE inhibitor for heart protection (ramipril and perindopril proven in large randomized controlled trials).<sup>14-16</sup>
  - Unless contraindicated, all people with diabetes with evidence of CV disease or with CV disease risk factors should receive antiplatelet therapy — ASA 80 mg — 325 mg daily is recommended.<sup>14</sup>
  - Patients with diabetes (considered at high risk for CAD) should target LDL cholesterol levels at <2.5 mmol/L and total cholesterol to HDL cholesterol ratio (TC:HDL) at <4.0.
  - Patients diagnosed with Type 2 diabetes should be started on statin therapy at a dose of simvastatin 40 mg daily or equivalent (e.g., atorvastatin 20

mg).<sup>14</sup> Lipid levels should be assessed at 6 weeks and dose increased as appropriate. When monotherapy does not achieve lipid targets the addition of a second drug from another appropriate class of drugs should be considered.

- Blood pressure target for people with diabetes is <130/80 mm Hg. For those with no diabetic nephropathy, BP levels not at target may be treated with (in order of preference): ACE Inhibitor, ARB, cardioselective beta blocker, thiazide-like diuretic, long-acting calcium channel blocker. Use of one or more of the agents is recommended when BP targets are not reached with monotherapy.<sup>14</sup>
- All patients with diabetes who are smokers should be educated about the dangers of this practice, (especially in light of elevated CAD risk), urged and assisted to quit.
- **Foot problems** — poor circulation to the feet can lead to slow healing. Foot ulceration is more common in people with diabetes. This combination of factors can lead to easier infection. Also, if foot ulcers are left untreated, poor circulation can cause the tissue to die, leading to gangrene. If the situation is serious, the leg or a portion of it may need to be amputated.
  - Foot examinations should be conducted by both patients and health-care providers on an ongoing basis (at least annually, and at more frequent interval for those at high risk).<sup>17</sup> It is a good practice to advise patients with diabetes to check their feet every day. Physicians should look at their feet at every visit.
- **Erectile dysfunction** — Approximately 34 to 45% of men with diabetes are affected by erectile dysfunction. Increasing age, duration of diabetes, poor glycemic control, cigarette smoking, hypertension, dyslipidemia and cardiovascular disease are all factors that

**TABLE 8** Diabetes Care Checklist  
(Dale Dodge, Medicine Centre, Unipharm Wholesale Drugs, BC)

Issue	Interval	Date	Result
Blood Glucose	Daily	See log	
Fasting Blood Glucose (lab)	6 months		
HbA1C	3 months		
Albuminuria	Annually		
Creatinine Clearance	Annually		
Cholesterol	Annually		
Total Cholesterol			
LDL Cholesterol			
HDL Cholesterol			
Total/HDL Cholesterol			
Triglycerides			
Feet Check - self	Daily	See log	
Feet - Dr. Check	Each visit		
Lifestyle			
Exercise	Daily		
Smoking	Never		
Diet	As advised		
Blood Pressure			
Home	Daily	See log	
Pharmacy		See log	
Dr. Check	Each visit		

increase risk. All adult men with diabetes should be screened periodically for erectile dysfunction and a PDE5 inhibitor (e.g., sildenafil, tadalafil, vardenafil) offered as first-line therapy. Those resistant to this therapy should be referred to a specialist (e.g., urologist).

### PHARMACOLOGICAL CONTROL OF BLOOD GLUCOSE

#### Insulin Therapy for Type 1 Diabetes

Insulin regimens for people with Type 1 diabetes should be adapted to the individual's treatment goals, lifestyle, diet, age, general health, motivation, capacity for hypoglycemia awareness and self-management and social and financial circumstances.<sup>18</sup> The Diabetes Control and Complications Trial results showed that intensive treatment of Type 1 diabetes significantly delays the onset and slows the progression of microvascular complications (i.e., nephropathy, neuropathy, retinopathy). The following recommendations are included in the 2003 Canadian Diabetes Association guidelines.<sup>18</sup>

- Multiple daily insulin injections (3 or 4 per day) or the use of continuous subcutaneous insulin infusion (insulin pump) should be considered for optimal glycemic control.
- Insulin aspart or insulin lispro in combination with adequate basal insulin (e.g., NPH insulin, insulin glargine) is preferred to regular insulin to achieve postprandial glycemic targets and improve A1C while minimizing risk for hypoglycemia.
- Insulin glargine (released Feb. 1, 2005 in Canada) provides 24-hour basal insulin and has been shown to lower fasting plasma glucose levels and result in less nocturnal hypoglycemia compared to once- or twice-daily NPH insulin. It should therefore be considered when patients encounter problems in reaching fasting plasma glucose targets or experience overnight hypoglycemia. Insulin glargine must not be mixed with other insulins in the same syringe (due to its acidic pH).
- Insulin lispro and insulin aspart should

be administered 0 to 15 minutes before meals, but can also be administered up to 15 minutes after a meal if necessary. Regular insulin should be administered 30 to 45 minutes before a meal.

#### Pharmacological Management of Type 2 Diabetes

The United Kingdom Prospective Diabetes Study (UKPDS) demonstrated that tighter control of blood glucose resulted in significant reduction in onset and progression of microvascular complications in people with Type 2 diabetes. The following recommendations for pharmacological management of Type 2 diabetes are included in the 2003 Canadian Diabetes Association guidelines.<sup>19</sup>

- In overweight patients (BMI  $\geq 25$  kg/m<sup>2</sup>) with mild to moderate hyperglycemia (A1C  $< 9.0\%$ ), therapy should be started with metformin alone or in combination with an insulin sensitizer (e.g., pioglitazone, rosiglitazone), or insulin secretagogue (e.g., glyburide, glimepiride, glizalide, nateglinide, repaglinide), or basal insulin or acarbose.
- In non-overweight patients (BMI  $< 25$  kg/m<sup>2</sup>), with mild to moderate hyperglycemia (A1C  $< 9.0\%$ ), therapy should be started with one or two antihyperglycemic agents that include either metformin, an insulin sensitizer, an insulin secretagogue, basal insulin or acarbose.
- In patients with mild to moderate hyperglycemia who are still not at target after oral drug combinations, basal insulin may be used alone or in combination with metformin, an insulin secretagogue, an insulin sensitizer or acarbose.
- In patients with marked hyperglycemia (A1C  $\geq 9.0\%$ ), therapy should be started with two antihyperglycemic agents from different classes or with basal and/or preprandial insulin. Addition of another oral antihyperglycemic from a different class or basal insulin should be considered when oral therapy has not succeeded in reaching target. In the circumstance where basal insulin therapy is started initially, the dose may be intensified or an oral agent may be added to therapy.
- Timely adjustments to and/or additions of oral antihyperglycemic agents and/or insulin should be made to attain target A1C within 6 to 12 months.

**THE PHARMACIST AND DIABETES CARE**

Patients with diabetes require many medications and ongoing care to reduce risks associated with their condition. Pharmacists interact with diabetes patients more often than any other health professional and need to seize these opportunities to educate patients and nurture the clinical relationship that will optimize their diabetes outcomes. Many educational tools have been presented in this lesson. These tools have been designed to help pharmacists dialogue with patients while raising awareness about individual risk for diabetes, educating patients about prevention of diabetes and symptom recognition of the condition, increasing knowledge about diagnosis of diabetes and identifying targets for management of blood glucose and other metabolic syndrome risk factors.

Ongoing care is vital for the patient with diabetes. A care tool such as that presented in Table 8 is a helpful resource for involving patients in their own health management. Pharmacies that create a tool like this can use it for much needed ongoing assessment and teaching of patients with diabetes. The role of the pharmacist in diabetes care is dynamic and can evolve to whatever level is

desired. Innovative approaches to diabetes patient care in this growing segment of our society offer a win-win proposition for patient care and the pharmacist's professional satisfaction. Appropriate reimbursement mechanisms will be required to make these ideals a reality.

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**QUESTIONS**

**Case #1**

RV is a 48-year-old man who has just been diagnosed with Type 2 diabetes. His LDL panel just conducted showed: LDL cholesterol = 3.4 mmol/L, HDL cholesterol = 0.9 mmol/L, Total Cholesterol = 6.7 mmol/L, triglycerides = 2.4 mmol/L. RV has an average blood pressure reading of 140/90 mm Hg.

**1. Does RV have the metabolic syndrome?**

- a) Yes, as a result of his blood pressure, triglycerides and HDL levels.
- b) No, we would need to know his waist measurement first.
- c) No, because his triglycerides are not elevated.
- d) No, because his blood pressure is normal.

**2. Is RV at his target total cholesterol to HDL ratio?**

- a) Yes, he is at target, which is 5.0.

- b) No, he is not at target which is 4.0.
- c) Yes, he is at target which is 6.0.
- d) We do not have enough information to specify target.

**3. If RV weighs 90 kg and is 170 cm tall, is he at a healthy BMI?**

- a) Yes, because his BMI is less than 30 kg/m<sup>2</sup>.
- b) No, because his BMI is approximately 28 kg/m<sup>2</sup> which is above the cutoff value of 27 kg/m<sup>2</sup> for increased risk of health problems.
- c) No, because his BMI is approximately 32 kg/m<sup>2</sup> which means he is obese and at high risk for developing health problems.
- d) No, because his BMI is approximately 42 kg/m<sup>2</sup> which puts him at very high risk for developing health problems.

**4. Which statement is CORRECT about the metabolic syndrome and risk for Type 2 diabetes?**

- a) All people with metabolic syndrome eventually progress to Type 2 diabetes.
- b) Metabolic syndrome is not associated with elevated blood glucose levels.
- c) A percentage of people with metabolic syndrome progress to Type 2 diabetes.
- d) Metabolic syndrome occurs in all people with a BMI greater than 24 kg/m<sup>2</sup>.

**5. Which option would be the best choice for RV should he decide to lose weight?**

- a) Start on a diet that allows him to take off 10 pounds in 2 weeks.
- b) Remove all carbohydrates from his diet.
- c) Increase proteins to 40% of caloric intake.
- d) Engage in a program that will allow him to lose weight at a rate of 2 to 4 pounds per month.

**6. If RV wishes to become more physically active, which approach would be**

most appropriate for his weekly activity?

- Begin jogging daily for 20 minutes, 4 days in a row, rest 3 days and repeat on a weekly basis.
- Go out for a brisk walk with his dog, accumulating at least 150 minutes of walking weekly over at least 3 nonconsecutive days.
- Bike for 10 minutes a day.
- Swim for 90 minutes once a week.

### Case #2

JG is a 42-year-old female who has just had a fasting plasma glucose test result of 5.9 mmol/L. She was diagnosed with hypertension three years ago and is currently treated with ramipril 10 mg daily. Her BMI is 30.1 kg/m<sup>2</sup>.

**7. Which statement about JG's circumstances is CORRECT?**

- She should have an oral glucose tolerance test performed in order to determine whether she might be glucose intolerant.
- She should return in two years for another fasting plasma glucose test since her last test was normal.
- She has "impaired glucose tolerance" as uncovered by her fasting plasma glucose test results.
- It is only a matter of time before she is diagnosed with Type 2 diabetes.

**8. JG returns 10 months later. She has gained 4 kg in weight and has been diagnosed with Type 2 diabetes. Which antihyperglycemic medication would be most appropriate if the doctor wants to start therapy immediately?**

- Rosiglitazone
- Glyburide
- Acarbose
- Metformin

### Case #3

LT is a 55-year-old male who was diagnosed with Type 2 diabetes five years ago. He has been taking metformin 500 mg three times daily for blood glucose control. His doctor has just prescribed glyburide 2.5 mg twice daily in addition to his metformin. He also takes atorvastatin for dyslipidemia. He has recently been diagnosed with albuminuria and his creatinine clearance is 50 mL/minute. His blood pressure is currently under control.

**9. Which statement about LT and blood glucose monitoring is CORRECT?**

- Since LT has Type 2 diabetes, he only needs to monitor once a week.
- Since LT has just received new anti-hyperglycemic therapy, he should test at least once daily.
- LT should monitor twice weekly.
- LT need only monitor if he feels hypoglycemic.

**10. If LT does monitor, what time of day should he monitor?**

- Before breakfast once a day.
- Before and after meals at least once daily.
- Before breakfast and at bedtime.
- After meals only.

**11. Which additional medication has a definite indication for LT under his current circumstances?**

- ASA
- Amlodipine
- Indapamide
- Metoprolol

**12. Which medication would be most appropriate to treat albuminuria diagnosed in LT?**

- Perindopril
- Amlodipine
- Acebutolol
- Irbesartan

**13. How often should LT have his eyes checked for signs of retinopathy?**

- Every 6 months
- Every 1-2 years
- Every 3-5 years
- Only people with Type 1 diabetes need to be checked for retinopathy.

**14. Which treatment is optimal for preventing the progression of peripheral neuropathy?**

- Tricyclic antidepressants
- Anticonvulsants
- Optimal lipid control
- Tight glucose control

**15. If after 6 months LT is still not at target for his blood glucose (A1C = 9.3%), which therapeutic option would be most appropriate?**

- add nateglinide or insulin
- add gliclazide or insulin
- add rosiglitazone or insulin
- add glimepiride or insulin

**16. Which would be the most appropriate post-prandial plasma glucose target for LT?**

- 11.0 — 13.0 mmol/L
- 4.5 — 6.0 mmol/L
- 5.0 — 10.0 mmol/L
- 7.0 — 12.0 mmol/L

### Case #4

SL is a 19-year-old female with Type 1 diabetes. Besides her insulin, she is currently taking a low-dose estrogen-progesterin combination oral contraceptive.

**17. What is the best insulin regimen for optimal blood glucose control?**

- Regular insulin 3 times daily plus basal NPH insulin.
- Basal NPH insulin plus insulin aspart or insulin lispro 3 or 4 times daily.
- Basal insulin glargine plus regular insulin before meals.
- Insulin lispro before breakfast and dinner.

**18. If SL has problems with nocturnal hypoglycemia while using insulin aspart plus NPH insulin, which would be the best option?**

- Switch insulin aspart to insulin lispro, adjust dose appropriately.
- Use regular insulin instead of insulin aspart, adjust dose appropriately.
- Reduce the dose of NPH insulin by one-half.
- Substitute insulin glargine for NPH insulin and adjust dose appropriately.

**19. Which statement about insulin is TRUE?**

- Insulin aspart may be injected up to 15 minutes after a meal.
- Regular insulin may be injected up to 30 minutes after a meal.
- Insulin lispro must be injected 30 to 45 minutes before meals to be effective.
- Insulin lispro and insulin glargine are an effective combination when mixed together in the same syringe.

**20. How often should SL monitor her blood glucose?**

- Once or twice a day
- Once daily before a meal
- At least 3 times daily
- Twice daily at different times of day.

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