New guidelines for the management of diabetes: a physician's guide

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Education

Éducation

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See the supplement to this issue

The *1998 Clinical Practice Guidelines for the Management of Diabetes in Canada* (distributed as a supplement to this issue of *CMAJ*) incorporate recent advances in diagnosis and outpatient management of diabetes mellitus and explicitly identify and assess the evidence in support of the recommendations. These guidelines are not intended as a textbook of diabetes care; rather, they address key issues and areas of controversy. We hope that they will also form the basis for care maps and locally adapted guidelines across Canada. Technical review articles for each area of the document are now being developed with the primary care physician in mind.

Canada and the world are experiencing a burgeoning epidemic of diabetes. The prevalence rate is expected to reach 3 million by the year 2010 in Canada alone. Professionals at all levels of the health care system can expect to see more patients with this multifaceted disease and to encounter more challenges in their treatment.

The new guidelines recommend screening everyone over 45 years of age, using easier and more sensitive diagnostic procedures, managing diabetes with a view to attaining tighter control of glucose levels, and screening people with diabetes for long-term complications with more defined methods to improve the chances of avoiding or delaying such problems. Cost-effectiveness analyses suggest that reducing the frequency of the complications of diabetes will lead to savings in health care costs related to diabetes care.[1–3] The primary care physician is the first and frequently the principal medical contact for anyone with diabetes. Given the long-term social and economic benefits of tighter control of glucose levels and the improvements that are possible in quality of care, it is hoped that primary care physicians will incorporate these clinical practice guidelines into their practices.

The following scenarios highlight the significant recommendations in the new clinical practice guidelines.

Scenario 1: Type 2 diabetes mellitus

Patient profile

A 46-year-old male executive requests a complete physical examination to determine his health status and, in particular, his risk of cardiovascular disease. He is overweight, has a family history of type 2 diabetes, smokes a pack of cigarettes a day and complains of fatigue.

As well as performing a routine examination and taking the patient's history, would you screen for diabetes? What cardiovascular risk factors should you be looking for?

Screening

Because type 2 diabetes is common and may be present for up to 7 years before symptoms appear, screening should be performed every 3 years in those over 45 years of age (recommendation 14). More frequent or earlier testing (or both)

should be considered in those with additional risk factors for diabetes such as obesity and a family history of the disease (recommendation 15). Annual testing should be considered in those with specific risk factors, such as a history of impaired glucose tolerance, impaired fasting glucose or gestational diabetes mellitus, or presence of hypertension, coronary artery disease or other complications associated with diabetes (recommendation 16).

A fasting plasma glucose level of greater than 7.0 mmol/L predicts the development of microvascular disease and permits the diagnosis of diabetes on the basis of a commonly available, reliable test (recommendation 6 and Table 4 of the guidelines) (note that the cutoff value in the earlier version of these guidelines was 7.8 mmol/L). Even in the presence of classic symptoms, if the fasting plasma glucose level is elevated, the test should be repeated on another day to confirm the diagnosis, unless there is severe hyperglycemia with acute metabolic decompensation (see Table 4 of the guidelines).

A fasting lipid profile (total cholesterol, triglycerides, high-density lipoprotein cholesterol and calculated low-density lipoprotein cholesterol) should be performed in adults with diabetes and should be repeated every 1–3 years as clinically indicated (recommendation 88 and Table 12 of the guidelines). The blood pressure should be evaluated, as people with type 2 diabetes are frequently hypertensive at the time of diagnosis. Higher blood pressure is generally correlated with obesity, decreased physical activity and older age. The results of the screening tests requested for patient 1 are presented in Table 1.

Treatment goals

For many people with diabetes, improving metabolic control will achieve the main objectives of optimizing health-related quality of life and preventing long-term complications. The metabolic goals of treatment must be individualized and should include consideration of the family and other psychosocial factors. It must always be remembered that the patient with diabetes is the key member of the diabetes health care team (see section entitled "Organization of diabetes care," page S3).

Management

Patients should strive for the best possible glucose control. The Diabetes Control and Complications Trial clearly demonstrated the value of tight control of glucose levels in preventing and reducing the complications in type 1 diabetes.[4] Likewise, other studies support the value of intensive therapy in preventing or slowing the progression of complications in type 2 diabetes.[5,6] (See Tables 5–9 of the guidelines.)

At time of diagnosis and beyond

When type 2 diabetes has been diagnosed, the physician should take a number of steps.

- Perform a comprehensive medical interview and physical examination focusing on the nature and extent of the symptoms of diabetes and the risk factors for cardiovascular disease and other complications.
- Request appropriate laboratory investigations, including glycated hemoglobin (recommendation 19) and plasma glucose levels (correlated with blood glucose meter result whenever possible; recommendation 22), urinalysis, routine biochemistry and complete blood count as indicated (see section entitled "Management: examination and assessment," page S9).
- Refer patient for diabetes education and dietary counselling (recommendations 1–3, 23–25).
- Initiate counselling for smoking cessation.
- Initiate recommendations for exercise (recommendations 27–30).
- Evaluate risks and long-term complications.

  Cardiovascular complications
  - Assess complete fasting lipid profile annually and initiate appropriate treatment of dyslipemia to achieve target levels (recommendations 88 and 89) (as indicated in Table 12 of the guidelines for people with diabetes and various other risk factors).
  - Monitor blood pressure and treat hypertension to attain target level of 130/85 mm Hg or lower (recommendations 90 and 91).
  - Perform resting or exercise electrocardiography (recommendation 29).

  Nephropathy
  - Perform dipstick urinalysis regularly to screen for gross proteinuria. If negative, check albumin:creatinine ratio annually on a random daytime urine

Table 1: Screening results for patient 1

Test	Result	Assessment	Action
Glucose			
FPG	9.2 mmol/L	Abnormal	Test again
Repeat FPG	7.5 mmol/L	Diabetes confirmed	Initiate diet and exercise prescriptions
Triglycerides	4.6 mmol/L	Elevated	
Cholesterol			
HDL	0.83 mmol/L	Below normal	
LDL	4.8 mmol/L	Elevated	
Blood pressure	145/85 mm Hg	Borderline elevated	Repeat test in 2–4 mo

Note: FPG = fasting plasma glucose level, HDL = high-density lipoprotein, LDL = low-density lipoprotein.

sample (recommendation 73). If positive, evaluate 24-hour urine to quantify urinary protein and creatinine clearance (recommendation 77).
- Consider therapy with angiotensin-converting enzyme inhibitor to prevent or delay proteinuria (recommendation 75).

Retinopathy
- Screen for retinopathy at time of diagnosis (recommendation 67). Have screening performed by an experienced professional trained in direct ophthalmoscopy through dilated pupils or by a retinal specialist. For those with no or minimal retinopathy, the recommended screening interval is 2 years and should not exceed 4 years (recommendation 68).

Neuropathy
- Assess for decrease or loss of vibration sense, loss of sensitivity to a 10-g monofilament at the great toe, or absent or decreased ankle reflexes (recommendation 79).
- Because sexual dysfunction is common and patients may be reluctant to volunteer information, make specific inquiries about this potential problem (recommendation 83).

Follow-up visits

- Schedule routine visits at 2- to 4-month intervals with directed history for diabetes (as in Table 7 of the guidelines).
- Perform foot exam and take blood pressure at every visit (recommendations 84 and 90).
- Evaluate progress toward reduction of risks and adjustment of treatment plans. If individual goals have not been attained within 2 to 4 months, introduce the next mode of therapy according to a stepwise approach (see Fig. 1 of the guidelines); make changes to diet and education as needed.

Scenario 2: Pregnancy and pre-existing diabetes

Patient profile

A 34-year-old woman with type 1 diabetes (diagnosed at age 12) presents with nighttime hypoglycemia. Two years previously she underwent successful laser surgery for retinopathy in one eye. She is especially concerned about the problems in control of glucose because she is trying to conceive. She is taking insulin twice a day (according to a split-mixed protocol). What risks does this patient face? What steps should be taken to minimize the risks?

Initial assessment

Because this patient wants to become pregnant, her risk of diabetes-related and pregnancy-related complications must be carefully assessed. In the absence of careful prepregnancy planning and follow-up, maternal diabetes is associated with an increased risk for the fetus of spontaneous abortion, congenital malformations, perinatal morbidity and death. For the mother, both retinal and renal disease may worsen during pregnancy. Given that this patient has proliferative retinopathy that may worsen during pregnancy, she *must* undergo an ophthalmic assessment before conception by an experienced retinal specialist to evaluate the potential risk of blindness (recommendations 69 and 70) if she does become pregnant.

Treatment goals

Any woman planning pregnancy should attempt to attain "ideal" control of blood glucose (see Table 11 of the guidelines) and should undergo a thorough evaluation of the risks of progression of any long-term complication already present. Such patients should be referred to a high-risk pregnancy clinic, if available (recommendations 50–52).

Management

- Insist on contraceptive use until ideal glucose control is achieved. Stress the importance, in terms of both maternal and fetal health, of delaying conception until such control is achieved (recommendation 51).
- Refer the patient to a specialized diabetes-in-pregnancy health care team to assess the level of glycemic control and the status of microvascular complications and to plan appropriate care before and during the pregnancy (recommendation 50).
- Patients such as this one are candidates for intensive insulin therapy, even if they are not considering pregnancy. Therefore, refer the patient to an endocrinologist for initiation of multiple daily injections (recommendations 34–36). Insulin lispro is not recommended in this case, because there is insufficient data to support its safety during pregnancy (see section entitled "Insulin use in type 1 diabetes," page S16).
- Because rapid improvement in glucose control may cause more rapid progression of retinal disease, it is imperative that target glucose goals be achieved and that eye disease be stable for at least 2–4 months before conception (recommendation 69).
- Monitor and treat hypertension, if present, because elevated diastolic blood pressure is a risk factor for the development of macular edema, and elevated systolic blood pressure is a risk factor for loss of vision (recom-

mendation 66). Note that angiotensin-converting enzyme inhibitors cannot be used during pregnancy.

Scenario 3: Diabetes in elderly patients

Patient profile

A new patient, a 76-year-old obese woman with type 2 diabetes (diagnosed 15 years previously) who is taking glyburide, presents with fatigue, low spirits, occasional incontinence and episodes of light-headedness. She lives alone, does what shopping she can manage and prepares her own meals. A medical history and physical examination reveal no significant coexisting conditions. She has never received formal diabetes education and does not know if she has ever been screened for complications. Given the patient's age, should her diabetes regimen be adjusted, and if so, what assessment and treatment options should be considered?

Assessment

As indicated by the results presented in Table 2, this patient has uncontrolled diabetes with minimal obvious symptoms and, in the absence of serious comorbidity, may have many years of life ahead. The renal threshold for glucose increases with age, so older people frequently do not exhibit the classic symptoms of hyperglycemia (such as polyuria or polydipsia) until blood glucose levels are markedly elevated. The risk of complications would increase in this patient if her control of glucose levels declined, so she should clearly undergo assessment of her degree of control of glucose level (recommendation 44). Her episodes of light-headedness might relate to hypoglycemia, especially if they occur in the middle of the day.

Treatment goals

As for younger patients, the goals are to maintain health in the broadest sense of the word and to reduce the risk of diabetes-related complications. The same glucose targets apply for otherwise healthy elderly people as for younger people with diabetes (recommendation 44). Finding the appropriate drug regimen will be especially important, given that it may be unrealistic to expect the patient to make significant lifestyle modifications (e.g., major weight loss, development of a regular exercise routine and institution of optimal dietary habits). In elderly patients, doses should be initiated at lower levels (recommendation 48 and Fig. 1 of the guidelines).

Management

- Refer the patient for diabetes education and dietary counselling with the goals of increasing patient understanding and participation in self-care, improving nutrition and losing weight. Interdisciplinary interventions have been shown to improve glycemia control in elderly people (recommendation 45).
- Encourage moderate exercise (recommendation 47).
- Evaluate the home profile of blood glucose level to assess diet compliance and degree of control and to rule out hypoglycemia (recommendation 21). In the absence of significant renal or hepatic insufficiency, add metformin to glyburide. Gastrointestinal side effects can be a limiting factor with metformin and should be monitored (recommendation 32). If hypoglycemia is a concern, gliclazide may be preferred, because it is associated with a lower frequency of hypoglycemia (recommendation 48). The importance of timing of intake of medication and food must be clearly explained.
- Follow a stepwise approach to management (see Fig. 1 of the guidelines) and adapt treatment as necessary. This often involves trying different combinations of oral agents and insulin therapy.
- Monitor and screen for complications at recommended intervals (see section entitled "Complications," page S20).
- Evaluate the need for social services or home care assistance to prepare meals, do shopping, assist with foot inspections and care, and other activities.

Scenario 4: Diabetes in aboriginal people

Patient profile

A 35-year-old aboriginal man 1.78 m tall and weighing 100 kg presents with a foot sore of 2 months' duration. He lives on a reserve outside a major urban centre, has a family history of diabetes, smokes and denies any classic symptoms or complaints of diabetes. What immediate and long-term risks does this patient face?

Table 2: Initial results for patient 3

Test	Result	Assessment	Action
FPG level	10.3 mmol/L	Inadequate control	Augment intensity of treatment plan (step up treatment)
Glucose level 2 h after meal	17.4 mmol/L	Inadequate control	
Hemoglobin A_{1c}	0.097	Inadequate control	

Screening

This patient has multiple risks factors for diabetes: he is overweight, he has a family history of the disease, and he smokes. Aboriginal Canadians have age-adjusted prevalence rates of diabetes of 19% to 26%, among the highest reported rates in the world. Careful examination of the foot reveals an ulcer, which suggests possible peripheral neuropathy. Neuropathy is confirmed by the patient's inability to feel a 10-g monofilament at the great toe (recommendation 79). A casual blood glucose test performed in the office laboratory shows a level of 17 mmol/L. A repeat fasting test on another day confirms the diagnosis. Although the patient denies other symptoms of diabetes, his hyperglycemia and risk profile make him a candidate for aggressive screening for other diabetes-related complications — coronary artery disease, nephropathy, neuropathy in other body systems (somatic and autonomic) and retinopathy — according to the practice guidelines (see section entitled "Complications," page S20).

Treatment goals

This patient is at immediate and high risk of serious infection and potential amputation. The immediate goal is to control the foot infection and ulcer and attain glucose control. The longer-term goal is to reduce his risk of further complications or worsening of the neuropathy. In patients with type 2 diabetes, lower glucose levels are associated with reduced frequency of neuropathy; intensified therapy may also improve neuropathy (recommendation 81). Equally important is the goal of increasing the patient's understanding of the disease to encourage self-management.

Management

Immediate

- Treat infection with antibiotics and refer the patient to a health care professional with experience in treating foot ulcers and performing diabetes foot care (recommendation 86).
- Optimize diabetes control with oral agents and with insulin if required (recommendation 81).
- Admit to hospital if necessary for treatment of the foot ulcer and optimization of glucose control (recommendation 86).

Once foot ulcer has resolved

- Refer patient for formal diabetes education, through (where possible) community health representatives and other outreach services. The diabetes education must show recognition, respect and sensitivity for the patient's language, culture and geographic setting (recommendations 63–65).
- Encourage lifestyle changes (exercise, weight loss, diet and smoking cessation).
- In people with significant symptoms of neuropathy, referral for additional neurological evaluation may be helpful (recommendation 83).
- Screen aggressively for other microvascular and macrovascular complications.
- Undertake preventive foot care. Appropriate management can heal foot ulcers and prevent their recurrence, thereby greatly reducing the risk of amputation (people with diabetes have an age-adjusted amputation rate 11 times higher than people without the disease). Simply looking at the foot regularly has been shown to reduce amputations dramatically (recommendation 84). The patient's poor socioeconomic status, previous ulceration, smoking habit and neuropathy are among a list of characteristics that confer a high risk of amputation. Therefore, foot examination should be an integral component of diabetes management and should be performed daily by patients and at every office visit (recommendation 84 and Tables 8 and 10 of the guidelines). The patient should receive foot care education, including information about the importance of proper footwear, smoking cessation, avoidance of foot trauma, and early detection of and referral for problems (recommendation 85). Any infection must be treated aggressively (recommendation 86).

Scenario 5: Gestational diabetes mellitus

Patient profile

A 35-year-old woman presents to her physician for the first time at 10 weeks gestational age. She is well and reports no problems. Her first child was delivered vaginally without complications and weighed 4500 g. In addition to routine antenatal tests, would you test for diabetes?

Screening, results and diagnosis

All pregnant women should be screened for gestational diabetes mellitus between 24 and 28 weeks gestational age, with the exception of those in very low risk groups (e.g., lean white women under 25 years of age, with no family history of diabetes and no history of large babies) (recommendation 10). The preferred screening test uses a 50-g glucose load, given orally at any time of the day, with plasma glucose being measured 1 hour later. If the 1-hour value is 7.8 mmol/L or greater, a glucose tolerance test (involving a 75-g glucose load with samples being drawn

while fasting and at 1 and 2 hours after ingestion) is warranted. If the value is 10.3 mmol/L, then gestational diabetes can be diagnosed without further testing (recommendation 11).

Given the patient's history of a macrosomic baby and her age (older than 24 years), this patient clearly meets the criteria for screening. Because 2 of 3 values for oral glucose tolerance testing are elevated (Table 3), gestational diabetes mellitus is confirmed (recommendation 12 and Table 5 of the guidelines).

Treatment goals

The treatment goals for patients with gestational diabetes mellitus, discussed in the section entitled "Management: gestational diabetes mellitus," page S18), are as follows:

- To reduce the risk of morbidity for the baby (specifically, macrosomia, which carries with it the risk of a difficult vaginal birth, as well as neonatal hypoglycemia, hyperbilirubinemia, hypocalcemia and polycythemia).
- To reduce the risk of morbidity for the mother (operative or traumatic delivery, polyhydramnios, preterm labour).
- To recognize the risk for postpartum diabetes, impaired glucose tolerance and lipid abnormalities (known to occur more frequently in women who have had gestational diabetes mellitus), which would allow institution of preventive strategies such as lifestyle changes in terms of diet and physical activity to minimize the progression to more significant disease (recommendations 61 and 62).

Management

- Provide dietary counselling to ensure a well-balanced diet with the goal of achieving normal maternal glucose levels and normal weight gain in the mother and fetus (recommendations 57 and 58).
- Monitor fasting and postprandial glucose levels. Initiate insulin therapy if target glucose levels are not attained through diet therapy (recommendation 59). Note that oral hypoglycemic agents are contraindicated during pregnancy.
- Encourage regular and moderate exercise, if not contraindicated for obstetric reasons (recommendation 60).
- At 6 weeks to 6 months after the birth, perform an oral glucose tolerance test (testing at 2 hours after administration of a 75-g glucose load) to determine nonpregnant glucose tolerance (recommendation 62).

Table 3: Screening and diagnostic results for patient 5

Test	Result, mmol/L	Assessment	Action
Glucose screening*	8.9	Elevated	Perform oral glucose tolerance test
Oral glucose tolerance test†: plasma glucose level			
Fasting	5.7	Elevated (> 5.3)	Treat diagnosed gestational diabetes mellitus
1 h after glucose administration	11.2	Elevated (> 10.6)	
2 h after glucose administration	7.9	Normal (< 8.9)	

*50-g load; test performed 1 hour after administration.
†75-g load.

Conclusion

It is hoped that reviewing these typical patient profiles and seeing how the recommendations may help in management will prompt physicians to keep the entire document at hand for use and reference as necessary. Because of the innumerable clinical, geographic and economic realities of clinical practice settings across the country, it is obvious that no single set of recommendations can be applied uniformly. We have tried to cull the literature and clarify the science to provide a base for making clinical decisions in the outpatient management of diabetes. Each area, practice setting and geographic region is encouraged to adapt the clinical practice guidelines to its specific needs and to develop appropriate care plans and management protocols if and when needed.

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