Optimal Management of Type 2 Diabetes

Adapted from CDA 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. *Can J Diabetes* 2003; 27(suppl 2). *See* [CDA Website]

Diagnosis of Diabetes	**Either**	**or**	**or**
A confirmatory PG test must be done in all cases on another day in the absence of unequivocal hyperglycemia accompanied by acute metabolic decompensation.	FPG ≥ 7.0 mmol/L	Casual PG ≥ 11.1 mmol/L + symptoms of DM (polyuria, polydipsia, unexplained weight loss)	2 hour PG in a 75 gm OGTT ≥ 11.1 mmol/L

	PG (mmol/L)Levels for Diagnosis of IFG*, IGT† and Diabetes			
		FPG		**2 hour PG in a 75 gm OGTT**
	Normal	< 6.1		< 7.8
	IFG	6.1-6.9		N/A
	IFG (isolated)	6.1-6.9	and	< 7.8
	IGT (isolated)	< 6.1	and	7.8-11.0
	IFG & IGT	6.1-6.9	and	7.8-11.0
	Diabetes	≥ 7.0	or	≥11.1
	IFG = Impaired fasting glucose IGT = impaired glucose tolerance			

Identification of Metabolic Syndrome using NCEP ATP III criteria				
	Risk Factor		Defining Level*	
* Dx Metabolic syndrome when 3 or more of the risk parameters are present	FPG		≥ 6.1 mmol/L	
	BP		≥ 130/85 mm Hg	
	TG		≥ 1.7 mmol/L	
	HDL-C	Men	< 1.0 mmol/L	
		Women	< 1.3 mmol/L	
	Abdominal obesity		Waist circumference	
		Men	> 102 cm	> 40 inches
		Women	> 88 cm	> 34.6 inches

Screening & Prevention				
Screen FPG every 3 years >40 years of age; earlier & more frequently < 40 years of age with risk factors and as clinically indicated ≥ 40 years of age with risk factors*				
***Risk factors for DM:** • Age ≥ 40 years • 1^0 relative ⊆ DM • Ethnicity • Hx IGT or IFG • DM complications • Vascular disease • HTN • Dyslipidemia • Obesity • Hx GDM • PSOS • Acanthosis nigricans • Schizophrenia	FPG < 5.7 mmol/L	FPG 5.7-6.9 mmol/L plus risk factors for DM/IGT	FPG 6.1-6.9 mmol/L No risk factors for DM/OGT	FPG ≥ 7.0 mmol/L
	Rescreen as clinically indicated	2hPG in a 75 gm OGTT		
		Dx: IFG and/or IGT	IFG	Diabetes
		Prevention strategies (diet, exercise, weight loss) for DM/CVD. Rescreen at "appropriate intervals"		treatment

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Glycemic Targets (mmol/L)				
		A1C (%)*	FPG mmol/L	2 hour PC PG
Target for most patients		< 7.0	4.0-7.0	5.0-10.0
Normal range (if safely achievable)		< 6.0	4.0-6.0	5.0-8.0
* Glycosylated hemoglobin- a value of 7% corresponds to a lab value of 0.070				
Monitoring Glycemic Control (correlates with long term complication rate)				
A1C	• Reflects glycemic control over preceding 120 days • Monitor quarterly			
Self monitoring BG (SMBG)	• Individualize for patient empowerment, lifestyle flexibility • Hypoglycemia avoidance, intensive insulin monitoring • PC readings correlate with A1C • Include AC & 2 h PC readings			
Ketone testing: Type 1 diabetics	• During acute illness • When AC BG > 14 mmol/L • With symptoms DKA (nausea, vomiting, abdominal pain)			
Physical activity and Diabetes				
	• Consider TMT for previously sedentary diabetics undertaking more exercise than brisk walking • Moderate exercise of 150 weekly over 3 non-consecutive days or if willing ≥ 4 hours/week • Resistance exercise 3 times/week			
Nutrition therapy: Follow Canada's Guidelines for Healthy Living				
	• Eat a variety of foods			
	• Emphasize cereals, breads and other whole grain products, fruits and vegetables			
	• Choose lower fat dairy products, leaner meats and foods prepared with little or no fat			
	• Achieve and maintain a healthy body weight through regular physical activity and healthy eating			
	• Limit sodium, alcohol and caffeine			
Carbohydrate (50-55% 0f energy)	• Include whole grains, fruits, vegetables and milk			
	• Within same food category consume low glycaemic index foods			
	• Sucrose intake up to 10% of daily energy is acceptable			
	• The use of saccharin, aspartame, acesulfame potassium, cyclamates and sucralose is acceptable			
	• Intake of ≤ 10g/day of sugar alcohols (maltilol, mannitol, sorbitol, isomalt and xylitol) can be safe in those for whom it is deemed appropriate			
	• Up to 60 g of added fructose (e.g. fructose sweetened beverages and foods) is acceptable			
Protein (15-20% of energy)	• There is no evidence to suggest that usual protein intake (15-20% of energy) should be modified			
Fat (< 30% of energy)	• Restrict combined saturated fats and trans fatty acids to < 10% of energy intake			
	• Limit polyunsaturated fat to < 10% of energy intake			
	• Consume monounsaturated fats instead of saturated fats more often			
	• Include foods rich in polyunsaturated omega-3 fatty acids and plant oils			
Vitamin and mineral supplements	• Routine supplementation is not necessary			
	• In the case of identified deficiency, limited dietary intake or special need, supplementation may be recommended			
Alcohol	• People using insulin or insulin secretagogues should be aware of delayed hypoglycaemia that can occur up to 14 hours after alcohol consumption			
	• Limit intake to 1-2 drinks/day (< 14 standard drinks/week for men and < 9 drinks/week for women)			

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Pharmacotherapy of Type 2 Diabetes				
Tailored individual therapy targeting euglycemia in most patients ASAP with early aggressive therapy	• Dx of type 2 diabetes often delayed. 20-50% of patients with type 2 diabetes present with micro- and macro-vascular complications at the time of diagnosis. • Use combination oral hypoglycemic therapy (OHGT) in sub-maximal doses rather than maximum dose mono-OHGT • Aim to achieve A1C target within 6-12 months • Consider combination OHGT and bedtime insulin • Consider insulin therapy as initial agent when AIC≥9%			
	Mild-mod. hyperglycemia A1C < 9%		Marked hyperglycemia A1C ≥ 9%	
	BMI ≥ 25 kg/m^2	BMI < 25 kg/m^2 1 or 2 OHGT from different classes	2 OHGT agents from different classes	Basal and/or PC insulin
	Biguanide alone or in combo with	• Biguanide	• Biguanide	
	• Insulin Sensitizer	• Insulin Sensitizer	• Insulin Sensitizer	
	• Insulin secretagogue	• Insulin secretagogue	• Insulin secretagogue	
	• Insulin	• Insulin	• Insulin	
	• α-glucosidase inhibitor	• α-glucosidase inhibitor	• α-glucosidase inhibitor	
	If Not at Target	**If Not at Target**	**If Not at Target**	**If Not at Target**
	Add a drug from a different class or combine OHGT with insulin			Intensify insulin or add OHGT
	Timely adjustments to and/or addition of OHGT and/or insulin Should be made to attain target AIC within 6-12 months.			

Oral Hypoglycemic Class (OHGT)		Generic name	(Brand name)	Dose/Frequency
Biguanide		metformin	Glucophage®	500-850 mg BID-TID
Insulin sensitizers (TZDs)		rosiglitazone	Avandia®	2 mg BID-8 mg OD
		pioglitazone	Actos®	15-45 mg OD
Insulin secretagogues:	Sulfonylureas:	gliclazide	Diamicrom®/ MR, generic	80-160 mg OD-BID
		glimepiride	Amaryl®	1-8 mg OD
		glyburide	Diabeta®,Euglucon,generic	1.25-10mg OD/BID
	Non-sulfonylureas:	nateglinide	Starlix®	60-120 TID AC
		repaglinide	GlucoNorm®	0.5- 4 TID AC
Alpha-glucosidase inhibitor		acarbose	Prandase®	25 mg TID-50 mg TID (Wt≤60kg)/100mg TID (Wt>60kg)
Combination formulation		rosiglitazone/metformin	Avandamet®	1/500mg BID-4/1000mg BID
Anti-obesity agent		orlistat	Xenical®	120 mg TID

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Anti-hyperglycemic medications: Therapeutic Considerations	
Biguanide	• Contraindicated in patients with renal or hepatic dysfunction, or cardiac failure • Use Cockcroft-Gault formula (see "Nephropathy," p. S66) to calculate creatinine clearance (<60 mL/min indicates caution or contraindicates the use of metformin) • Associated with less weight gain than sulfonylureas and does not cause hypoglycemia • Gastrointestinal side effects
Insulin sensitizers (TZDs)	• Contraindicated in patients with hepatic dysfunction (ALT >2.5 times ULN) or significant cardiac failure • Between 6 and 12 weeks required to achieve full BG-lowering effect • Triple therapy: addition of TZD to metformin plus sulfonylurea is acceptable • May induce mild edema, fluid retention • When used in combination with insulin, may increase risk of edema and CHF. The combination of a TZD plus insulin is currently not an approved indication in Canada.
Insulin secretagogues:	• All insulin secretagogues reduce overall glycemia similarly (except nateglinide) • Postprandial glycemia is especially reduced by nateglinide and repaglinide • Hypoglycemia and weight gain are especially common with glyburide • Consider using other class(es) of antihyperglycemic agents first in patients at high risk of hypoglycemia (e.g. the elderly) • If a sulfonylurea must be used in such individuals, gliclazide and glimepiride are associated with less hypoglycemia than glyburide • Nateglinide and repaglinide are associated with less hypoglycemia in the context of missed meals
Alpha-glucosidase inhibitor	• Not recommended as initial therapy in people with severe hyperglycemia (A1C ≥9.0%) • Mostly used in combination with other oral antihyperglycemic agents • Gastrointestinal side effects • Treat hypoglycemia with dextrose tablets, milk or honey
Combination formulation	• See rosiglitazone and metformin
Anti-obesity agents	• Associated with weight loss • Gastrointestinal side effects

Macrovascular Complications, Dyslipidemia and Hypertension

Address all coronary risk factors in diabetic patients - 80% die as a result of a vascular event

See Guide for Comprehensive CV Risk Reduction Assess Risk Level
UKPDS Risk Engine / CV Life Expectancy Model

Priorities for vascular and renal protection:	Clinical issue	Target population	Interventions
	Vascular protection	All diabetics	ACE inhibitor as indicated Anti-platelet therapy (ASA) as indicated BP control Glycemic control Lifestyle modification • Weight reduction 5-10% • Regular aerobic exercise Lipid control Smoking cessation
	Elevated Blood Pressure	All diabetics with hypertension regardless of nephropathy	Treat according to hypertension guidelines
	Renal protection	All diabetics with nephropathy (even in absence of hypertension)	Treat according to nephropathy guidelines