

## Type 2 Diabetes 101

### Introduction

You have Diabetes Mellitus, or sugar diabetes. It is a potentially serious condition characterized by elevated blood sugar (glucose) that affects 5-10% of the population and commonly comes on after the age of 35. With appropriate therapy most of the complications of diabetes (heart attack, stroke, blindness, kidney damage and nerve damage) can be avoided. The key to avoiding these complications is to control the blood sugar: with lifestyle modification in all cases (& where necessary with medication) and to manage other risk factors - blood pressure, cholesterol and smoking.

You can measure your blood sugar yourself by near-painlessly pricking your finger using a simple blood glucose machine "glucometer" which costs < \$50 and single-use strips that cost around \$1.00 a piece. Testing your blood once a day before breakfast (preferably) or dinner (also acceptable) will give a good overall picture of your diabetes control. Normal or ideal values are 3.5-6.0. A value <7.0 before a meal is generally considered a good reading. Testing your blood 2 hours after a meal will tell you how well your body handled the meal – a normal value is 4-7; a value 6-10 is considered good. Your doctor may order a special laboratory test, the "A1c", which is an index of what your blood sugar has been over the last 2-3 months. Normal (non-diabetic, ideal) levels are 4.8 – 6.0. A value < 6.0 is regarded as ideal though values in this range should be targeted in caution in individuals who have established heart disease or stroke. A value <7.0 is considered good. A value of 7.0-7.9 is considered reasonable provided you do not have eye, kidney or nerve complications. Values above 7.9 are almost always unsatisfactory and require intervention.

The reasons you have developed diabetes are not fully known though two factors are well understood. The first factor is called insulin resistance. You were born with it (you probably inherited it from your parents). Insulin resistance means that although your body makes insulin just like everybody else, the insulin doesn't lower blood sugar as much as it should. Your body was able to keep your blood sugar normal for many years by producing more insulin than usual. Insulin resistance increases as you gain weight, particularly that around the waist. The second factor causing diabetes is exhaustion of the endocrine pancreas, the part of the body that produces insulin. Because of insulin resistance your body had to make extra insulin - it eventually became exhausted, causing blood sugar to rise and diabetes to result. Pancreatic exhaustion is part of natural aging explaining why diabetes is very common in the elderly.

Diabetes education can be received in person at accredited Diabetes Education Centres (attached to most major BC hospitals – you will require a referral through Dr. Elliott or your family physician); excellent information is also available online at [www.livewellwithdiabetes.com](http://www.livewellwithdiabetes.com) and other agencies such as the Canadian Diabetes Association [www.cda.ca](http://www.cda.ca).

### BLOOD GLUCOSE LOWERING THERAPY

These therapies are based on reversing or compensating for the factors that led to diabetes in the first place.

#### 1. Lifestyle therapy

Healthy eating is one of the keys to managing your diabetes. With the exception of fats, your body converts everything you eat into sugar. Starchy foods (carbohydrates) are converted into sugar faster than complex foods like vegetables or protein. Since your body has a limited capacity to secrete insulin it makes sense to eat small frequent meals of complex foods. This is termed a "grazing" diet. Grazing diets tend to be impractical therefore emphasis is placed on eating balanced meals by:

1. choosing complex carbohydrates (starches) rich in fibre such as whole grain breads, converted or brown rice & whole grain pasta.
2. limiting simple carbohydrates (sugars) by reducing regular pop, juices, candies & sweet baked goods. Limit fruit juice to 1/3 cup or less per day but include 2-3 fruits per day.
3. reducing fat intake: choose lower fat milk (2% or less) & cheese (20% or less), lean meats, skinless poultry. Eat less added fats such as butter, oils, margarine, mayonnaise and salad dressings.
4. eating small portions of protein: meat, poultry, fish, cheese, eggs.

5. including plenty of vegetables, especially dark green leafy vegetables.
6. limit alcohol consumption to no more than 1-2 standard drinks per day

Eating 3 meals a day is a good place to start. Some individuals may need to divide the starches further into 3 smaller meals with snacks. While you may wish to lose weight, and many people can lose weight in the short term, most people are unable to keep weight off over a 1-2 year time frame. It is often more realistic to focus on healthy eating and staying physically active rather than on the number on the scale.

Exercise will help you to eat in a healthy manner. You will also feel better once you get into a regular exercise program. Try to exercise 5-6 days per week. Start low and aim to gradually increase your level. Walking after the evening meal is a good place to start. Get a family member or a buddy to join you in your exercise program. Consider joining a gym.

## 2. Oral Medication

If after several weeks of diet and exercise your sugar is not down under 8-10, your doctor will suggest that you take medication. The medications discussed below all lower blood sugar and have the potential to cause low blood sugar or hypoglycemia. Other causes of hypoglycemia are unusual amounts of exercise or missed meals or snacks. Hypoglycemia is usually associated with sweating and shaking and palpitation and occasionally with altered vision or confusion. If this happens you should take a 1/2 glass of juice or regular pop and consider adjusting your medication.

Metformin helps your own insulin to work better – specifically it reduced the amount of sugar produced by your liver. It comes in 500 mg tablets (generic, no-name), or 850 mg with the brand name Glucophage and is taken at the beginning of the meal. It may upset your stomach a little at first, but this often improves with time. The starting dose is 1/2 a tablet with breakfast and dinner. After a few days, increase the dose to 1 tablet with breakfast and dinner. Depending on age and kidney function, if your sugar is still too high, the dose may be further doubled to 2 tablets with breakfast and 2 tablets with dinner. If, despite metformin (and of course good attention to lifestyle) it is still too high your doctor may suggest adding one or more other diabetes medications in addition to the metformin. Metformin may help you to lose weight.

Glyburide (“Diabeta”), gliclazide (“Diamicron”) and glimepiride (“Amaryl”), are all members of the “sulfonylurea” class of drugs and work by causing your body to produce more insulin. Glyburide comes in 2.5 or 5 mg tablets (taken once or twice daily with breakfast and dinner usually in a dose of 2.5 to 5 mg; maximum dose per day 20 mg). Gliclazide 80 mg is similar to glyburide 5 mg, & like glyburide is taken twice daily - the maximum dose is 320 mg/day. Diamicron also comes in a sustained release form Diamicron MR 30 mg which is taken once daily at the same time each day (maximum is 4 tablets per day). Amaryl is taken once daily (the time of day doesn’t matter but should be kept constant) & comes in 1, 2 and 4 mg tablets (starting dose usually 1 mg, maximum dose 8 mg). In general the dose is started low and taken quickly to half maximal levels if sugars are not controlled. Maximum doses are usually not much more effective than half maximal doses. The only common side effect is low blood sugar otherwise known as hypoglycemia. If low blood sugar occurs with any regularity, the dose of glyburide (or other similar medication) should be reduced by 50% or stopped completely. Amaryl is not covered by Pharmacare – the cost is \$0.70 per tablet regardless of strength.

There are a number of other oral medications used in Type 2 diabetes: these include Avandia & Actos (members of the “TZD” class) and Prandase. Dr. Elliott seldom uses these agents. The TZD class of drugs is associated with weight gain, fluid retention and occasionally heart failure. Prandase causes flatulence. If Dr. Elliott feels they are useful to you he will mention them specifically. If you are already taking these medications he may wish to discontinue them.

New agents are always coming to market. The “gliptin” class of drugs, taken once daily and essentially without side effects, has recently hit the Canadian market. The first arrival was sitagliptin (“Januvia”); it is taken in a dose of 100 mg/day; soon to arrive will be vildagliptin (“Galvus”).

## 3. Insulin therapy

Insulin treatment eventually becomes necessary in nearly every person with diabetes though it may take up to 10-20 years to become so. Insulin therapy is begun when blood glucose levels are too high despite the use of most or all

of the above classes of diabetes tablets taken together. Insulin is given by a near-painless injection using insulin pens or syringes. The technique is easily learned and can be taught to you in 20-30 minutes by a nurse in a diabetes education centre or specialized pharmacy.

Insulin is initially taken as a single dose (Lantus, Levemir, Novolin N or Humulin N). Dr. Elliott prefers to start with Lantus given before breakfast in a dose of 0.15 U per kg. See the article “basal insulin adjustment” at <http://drtomelliott.com/handouts/diabetes> for more details including examples. Levemir, Novolin N and Humulin N can be started in the same dose but are usually given at bedtime. Regardless of the insulin, the dose is increased every day or every second day by 1-2 U each time until the sugar before breakfast is “to target”. Once it is “to target” the dose is kept steady. Your doctor will give you the target – it is usually 5-7. Sometimes insulin needs to be taken twice daily (usually before breakfast and bed, sometimes before breakfast and dinner) in which case the doses are started out at roughly the same level morning and evening of 0.1 U per kg with each dose. The doses can be increased by 1-2 U each day until target values are reached.

In some cases short acting insulin (NovoRapid, Humalog, Novolin R or Humulin R) may also be given before one or more meal. The dose of pre-meal short-acting insulin is generally adjusted depending on the amount of starchy food to be eaten in the upcoming meal and the blood sugar value 2 hrs after the meal. These concepts are discussed in other handouts (“Type 1 diabetes 101” and “Carbohydrate counting” which can be downloaded from [www.drtomelliott.com](http://www.drtomelliott.com) by following the link to “Handouts”.

The only common side effect of insulin is low blood sugar. If hypoglycemia occurs, regular pop, juice or starchy food should be taken immediately and the dose of insulin that caused the low sugar (usually the most recently taken shot) should be reduced by 20% on subsequent occasions.

## **BLOOD PRESSURE THERAPY**

Achieving a blood pressure value <140 is absolutely essential as higher levels are associated with increased risks of heart attack and stroke. Many authorities recommend a blood pressure target of <130 – these include the Canadian and American Diabetes Associations. Studies are underway to determine if targets should be lower still: <120! Your doctor will advise you what your target is. Lowering blood pressure not only reduces heart attack and stroke but also reduces the risk of damage to the eyes (retinopathy), kidneys (nephropathy and microalbuminuria) and nerves (neuropathy). If you have any of these conditions you will be prescribed blood pressure lowering medication even if you blood pressure is to target. Where appropriate, improved physical fitness & reductions in weight, alcohol consumption & salt intake will help reduce your blood pressure. In most individuals with Type 2 diabetes 2 or more blood pressure lowering medications will be required. They will be chosen from the following classes and used in combination.

1. ACE inhibitors (ACEIs) – commonly used brands include ramipril (Altace”, enalapril (Vasotec), quinapril (Accupril), fosinopril (Monopril), & perindopril (Coversyl). The only common side effect is cough, occurring in 10% of individuals.
2. Diuretics – commonly used agents are hydrochlorothiazide (HCTZ), chlorthalidone, spironolactone and amiloride. Two different diuretics may be combined in the same tablet. There are no common side effects.
3. Beta-blockers – commonly used agents include atenolol, metoprolol, propranolol, nadolol, acebutolol and carvedilol (Coreg). Asthmatics should under no circumstances take these agents. Common side effects include fatigue and erectile dysfunction.
4. ARBs – commonly used brands include losartan (Cozaar), irbesartan (Avapro), valsartan (Diovan), telmisartan (Micardis) & eprosartan (Teveten). There are no common side effects.
5. CCBs – commonly used agents include amlodipine (Norvasc), diltiazem (Cardizem, Tiazac), nifedipine (Adalat), felodipine (Plendil) & verapamil (Isoptin, Chronovera). The only common side effect is ankle swelling.

## **CHOLESTEROL THERAPY**

If your age is 50 or greater, your level of LDL cholesterol (otherwise known as “bad” cholesterol) should be <2.5 and your cholesterol risk ratio should be <4.0. If you have had a heart attack or stroke, regardless of your age and your cholesterol levels, you should receive a cholesterol lowering medication. Life style therapy (diet and exercise) is an essential component in any cholesterol lowering regime, however even with good lifestyle therapy most individuals with diabetes will not meet the targets above & will be prescribed cholesterol lowering medication. One of the

“statin” group of drugs will be used in nearly every case. The members of the statin class of agents and the two other commonly used classes are listed below. Sometimes agents from 2 or more classes are used together.

1. Statins – commonly used agents include simvastatin, atorvastatin (Lipitor), pravastatin (Pravachol) and rosuvastatin (Crestor). There are no common side effects. Muscle pain and weakness occasionally occurs. Hepatitis is rare. This class of drug is particularly good at lowering LDL cholesterol and the risk ratio.
2. Fibrates – commonly used agents include fenofibrate (Lipidil) and gemfibrosil. There are no common side effects. Muscle pain and weakness occasionally occurs. Hepatitis is rare. This class of drug is particularly good at lowering triglycerides (blood fat).
3. Ezetimibe (Ezetrol) – this agent has no common side effects.

## **QUIT SMOKING**

Smoking doubles your risk of having a heart attack or stroke and of dying. The risk due to smoking, in most cases is higher than that due to diabetes itself. There is no easy way to quit but you must want to quit before you have any chance of success. Cold turkey is recommended initially. If that fails you may consider the nicotine patch or medication such as bupropion (“Wellbutrin”) or varenicline (“Chantix”).

## **STEPS ON LEAVING YOUR DOCTOR’S OFFICE (get your doctor to strike out what is not required)**

1. Work on lifestyle therapy – this requires a life-long commitment.
2. Test blood sugar at least once daily (if only once, the best time is before breakfast or dinner) aiming for your individualized target. In most individuals values <7.0 before meals or 5-10 after meals are recommended. Use any blood glucose meter on the market. All are reliable. Some are faster or require smaller drops or can be used on the forearm. Others are semi-automatic that have magazines which hold up to 15 strips.
3. Book in for Diabetes Education classes. These will be available through all hospitals. The VGH Diabetes Centre is located at 4<sup>th</sup> floor, 2775 Laurel St, Vancouver (phone 875-5910, fax 875-8276). Classes in Cantonese and Mandarin are available through the Chinese Cultural Centre ph 604-687-0729. Classes in Punjabi are available through Richmond General Hospital ph 604-244-5163 and Surrey Memorial Hospital ph 604-585-5697. Diabetes classes are available online at [www.livewellwithdiabetes.com](http://www.livewellwithdiabetes.com) in multicultural format.
4. Book a follow-up appointment with your doctor & get laboratory test done a minimum of 3 working days beforehand.
5. Start ASA (aspirin) 81 mg per day to reduce the risk of heart attack & stroke.
6. Start blood pressure lowering medication.
7. Start cholesterol-lowering medication.
8. Make an appointment to have the back of your eyes examined by a skilled practitioner (either an MD ophthalmologist or a well-trained non-MD optometrist).