

TOM ELLIOTT MBBS
ENDOCRINOLOGY & INTERNAL MEDICINE

Dr. T.G. Elliott Inc.
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Type 1 Diabetes Careplan

You have Type 1 diabetes or insulin-dependent diabetes mellitus. This condition, when untreated, is characterized by very high blood sugar (glucose) – often above 20 at the time of diagnosis (normal is 4.0-6.0 for people without diabetes). Your blood sugar was/is high because there was/is a severe insulin deficiency in your blood. Insulin is required to control blood sugar – it causes sugar to be stored in all the cells of the body. Insulin is usually produced in special cells (“beta” cells) of your pancreas. Your insulin level was/is low because your beta cells have been destroyed by your own immune system. - this process is called “auto-immunity”. The trigger for auto-immunity is unknown but it may be related to viral infections and/or exposure to various antigens in the environment. By the time your diabetes became obvious fewer than 5% of your beta cells were still functional.

The problem with diabetes is that if blood sugar is allowed to be significantly above normal for many years irreversible damage to the eyes, kidneys, nerves and blood vessels may result. If blood sugar is kept close to normal throughout life, not only will you have very good quality of life but your life expectancy should be no different than people who do not have diabetes.

The key to living well with diabetes is to take insulin as prescribed (and to learn to adjust your doses), to test your blood frequently & to regulate your diet & exercise. With the help of your diabetes team of physician, nurse and dietitian and <http://thepatientclinic.ca> you will acquire these skills over the ensuing days, weeks and months. It will be a slow process of gradual adaptation; it will be tough but ultimately will bring tremendous rewards.

Blood Glucose Testing

You need to purchase a blood glucose meter. All the blood glucose meters on the market are safe, accurate and reliable. You need to find the one that suits your needs best - in terms of size, speed, amount of blood required, whether the meter has a magazine for storing multiple strips and whether add-ons such as software for blood glucose analysis are features you desire.

Frequent blood glucose testing is necessary to determine the correct dose of insulin, how your body responds to various foods, the effects of exercise or illness upon blood sugar and whether it is safe to drive and operate machinery. Factors that lower sugar are insulin and exercise. Factors that raise sugar are food, physical or psychological stress and illness.

The minimum requirement for blood glucose testing is to test upon waking, before going to bed and before each meal. Ideally you will also test after meals, at least some of the time. A good blood sugar when you wake up, before meals & bed and when you are asleep is 5-8 mmol/L (90-145 mg/dl). It is wise to test your blood at 2:00 or 3:00 AM every week or so to ensure you are not going low in your sleep. A good blood sugar two hours after a meal is 6-10 (110-180 mg/dl). To learn to control blood sugar by adjusting insulin and diet see “Insulin Therapy” below. To assist with the interpretation of your blood sugar readings you may upload your meter to <http://thepatientclinic.ca> – where an automated generic interpretation is available. With such uploads, and with your authorization, members of your diabetes care team will also be able to view your results and assist in interpretation.

If you need telephone help with insulin adjustment you may phone my office number 604-875-5900 – then 2 – then 2 to talk with a highly experienced diabetes nurse.

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A referral to the local Diabetes Centre, where you can meet the members of your diabetes team (MD, nurse and dietitian) will be arranged immediately after this appointment.

Apart from the blood glucose testing that you carry out yourself, another test called the “A1c”, usually performed at your local laboratory, is very helpful in assessing your long-term blood sugar control. The A1c is a guide to blood glucose control over the previous 3 months. Values in people who do not have diabetes are 4.2 - 6.0. In people with Type 1 diabetes who have been under treatment for 3 months or more a value < 7.0 is regarded as optimal, a value of 7.0 - 8.0 is regarded as moderate, and values >8.0 are regarded as inadequate. The A1c number is not the same as the value you get from your blood glucose meter though there is a close relationship between the two. Another test for determining long-term blood glucose control is fructosamine – it applies to the previous 2-3 weeks.

I recommend strongly that you have your A1c measured every 3 months. The result is primarily for you to see how you are doing, and also for me and other members of your care team. A requisition for A1c (and other tests that need to be done on an annual basis), good for two years and renewable thereafter (“standing order”) is attached to this Careplan. You may login to <http://thepatientclinic.ca/portal> to retrieve your A1c (and other results) 24-48 hours after the blood sample is drawn. If you wish you may configure <http://thepatientclinic.ca> to send you email or short-text reminders to get your A1c done, to inform you when the results have been posted and to upload your meter results.

Hypoglycemia is low blood sugar. It is often called a “low” or a “reaction” or a “hypo”. Low blood sugar is any reading under 4.0 when you don’t feel normal, or any blood sugar < 3.0 even if you feel normal, providing you have repeated the test and it is still <3.0. Hypoglycemia is potentially very serious as sugar is the fuel of the brain. Without adequate fuel the brain works less well or may stop working completely. This may cause lack of concentration, decreased attention, confusion, seizures, coma or even death. Hypoglycemia is treated by eating small quantities of sugar or starchy food like bread or crackers or by drinking sugary drinks like juice or regular pop (not diet pop which contains artificial sweetener, and no sugar). For a mild low the dose of sugar/starch is 10 grams - you will learn how much this is - roughly one rounded teaspoon of sugar or half a cup of juice. Your body will usually tell you that you are having a hypo - you will feel shaky, sweaty or feel your heart pounding. If you ignore those symptoms (or if you have had diabetes for many years) your brain may start to malfunction as mentioned above. If you feel low you should test your blood sugar and eat if you are indeed low. If you feel very low you should eat before testing your sugar.

Hyperglycemia is high blood sugar. Values >10 are often associated with increased urination and thirst. Increased urination is caused by sugar getting into your urine and dragging water out with it - thirst is a healthy response to the increased urine flow. If your sugar is persistently >15 & you are taking your insulin and following your diet it suggests that your body may be producing “ketones”. Ketones can be easily detected in your urine with test-strips available at any pharmacy. If ketones are present and your sugar is high you should drink copious quantities of water (not juice, milk or regular pop), and take small doses of rapid insulin (see below - say 10% of your total daily insulin dose) every 2 hours until the sugar is normal – if the sugar is not coming down within 6 hours you should go to the emergency room.

Insulin Therapy

Insulin needs to be present in your blood at all times – in small amounts when you are not eating (basal insulin) and in variable quantities at mealtimes (prandial insulin) depending on how much starchy food you eat. Insulin may be given by intermittent injections using a pen device or syringe or continuously/intermittently using an insulin pump. Technologies to allow insulin to be given by inhalation are available in the USA but not in Canada.

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Basal insulin The job of basal insulin (baseline/background insulin) is to stop the body from producing too much sugar when you are not eating. Your liver and muscles produce sugar to provide fuel for your body when you are in the fasting state. Basal insulin can be given by shots or by insulin pump. The discussion below pertains to shots – insulin pumps are excellent but expensive and unnecessary for most individuals.

Basal insulin is most simply given by a single daily shot of insulin glargine “Lantus”. Lantus is usually given in the morning though any time of day is acceptable but always at the same time of day. The dose is correct when the sugar before meals, bed and overnight is 5-8. If the sugar is <5 the dose is excessive and if >8 the dose is inadequate. Adjustments to doses should be made in 10% decrements (for sugar <5) or 10% increments (for values >8). An alternative basal insulin to Lantus is insulin detemir “Levemir” - however this insulin generally needs to be taken twice daily.

A prescription for Lantus using a simple-to-use pen is attached as part of this Careplan. If necessary, the pharmacist will teach you how to use the pen device.

An alternative to a single daily shot of Lantus or two shots of Levemir is two shots of intermediate-acting insulin. There are many different types of intermediate-acting insulin - Novolin N or Humulin N (known as “NPH” insulins), Novolin L or Humulin L (known as “Lente” insulins) or Novolin U or Humulin U (known as “ultralente” insulins). Intermediate-acting insulins are best given 12 hours apart with the second dose at your usual bedtime and the first dose 12 hours earlier. The dose of intermediate-acting insulin, like the dose of Lantus/Levemir, is adjusted according to the blood sugar before meals, particularly breakfast after fasting overnight (or a longer fast if you are resting, up to 24 hours!).

A further alternative for basal insulin administration is an insulin pump. Insulin pumps provide a higher level of control over basal insulin administration than do basal insulins such as Lantus or Levemir – insulin pumps allow the basal rate of insulin to be changed hour to hour. Insulin pumps are expensive and are not necessary for the vast majority of individuals with Type 1 diabetes.

What is the starting dose of basal insulin? For Lantus, take your weight in kilograms and divide it by 5 – take this many units of Lantus once daily. If you are taking Levemir, take your weight in kilograms and divide it by 10 – take this dose every 12 hours. If you are using intermediate-acting insulin, divide your weight in kilos by 10 and take that dose twice daily. Thus if you weigh 60 kg, the starting dose of Lantus would be 12 U once daily or Novolin N 6 U twice daily.

Meal-time insulin The ideal insulin for meal-times is ultra-short acting insulin (“ultra-short”). There are two brands of ultra-short, “Humalog” (insulin lispro) & “NovoRapid” (insulin aspart). These two insulins are essentially equivalent. The effect of ultra-short starts 10 minutes after injection, peaks 60-90 minutes after injection and is gone after 4 hours. Ultra-short is usually taken immediately before the meal. If there is a chance you might forget to eat after taking your ultra-short or if you are not sure how much starch you might eat, you may take it immediately after your meal.

The way to determine the correct dose of ultra-short is to test your blood sugar after you eat. A reasonable target 2 hours after a meal is 6-10. If your sugar is lower than the target you either took too much ultra-short or too little starch (see carb-counting below) and if it is higher you either took too little ultra-short or too much starch. Either way, you will know how to correct it next time.

Insulin pumps may be used to give meal-time insulin.

So at what dose of ultra-short should you start? For the average size meal most people require somewhere between 2 and 10 units of ultra-short. For beginners I would recommend you take no more than 2U to start

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unless you are >60 kg in weight. If you are <60 kg start with 1U. For children under 12 start with 0.5 U. By a series of experiments you can determine how much you need for any given meal.

A prescription for Humalog using a simple-to-use pen is attached as part of this Careplan. If necessary, the pharmacist will teach you how to use the pen device.

Carb-counting Carbohydrate (“carb”) counting is the process of making an intelligent guess as to how much starch or carbohydrate any individual foodstuff, or complete meal, contains. Carbs are usually estimated in units of grams (1 oz = 28 grams). The reason for counting carbs is that the dose of meal time insulin is directly proportional to the carbs you are about to eat. A separate carb-counting guide is attached to this Careplan.

Corrections You should always test before taking your mealtime insulin to see whether the previous dose of your basal insulin and/or mealtime insulin was correct. If your sugar is higher than your pre-meal target (usually in the range of 5-8), you may give yourself extra mealtime insulin, above and beyond what you would usually take for the carbs in the upcoming meal. This extra mealtime insulin is called a “correction” or “sliding-scale”. Usual corrections for people with a carb-ratio of 10 or 15:1 would be 1 extra unit for every 2 the sugar is above target. For people with a carb ratio <10:1, a correction of 1 for every 4 the sugar is above target. Thus if your before meal target is 5-8, and your carb ratio is 10:1 & your sugar before a meal is 12.0 you would take 2 a correction of 2 units. Here is the detail for the calculation: sugar now = 12, upper range of target = 8; 12-8 = 4. 4 divided by 2 = 2. Therefore correction dose is 2 units of mealtime insulin.

Driving/Operating Machinery and Diabetes

If you have a severe low while you are driving or operating machinery there is a risk of injury or death to you or others. It is therefore your personal, moral and civic responsibility that this never happens. You should never drive a car without knowing what your blood sugar is. You should not drive with a blood sugar under 5. You should never go out of the house without snacks to treat a low. If you are driving for longer for an hour you should stop every hour to test your blood sugar. If you have a motor vehicle accident with a low blood sugar it is likely that the Superintendent of Motor Vehicles will temporarily rescind your driver's licence. This will necessitate re-certifying through the Diabetes Centre and may cause you to lose your job.

Intercurrent Illness and Insulin

During intercurrent illness (colds, flu etc) your body will be less sensitive to insulin and you will therefore require more. The simplest approach is to increase your basal insulin doses by 20% (or more) and to take correction doses of mealtime insulin every 2 to 4 hours as well as your usual meal-time insulin.

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Patients name

Rx

Lantus Solostar (or penfil or vial)

**take 10 Units (or as directed) before breakfast
adjust dose as outlined (see attached document), repeat indefinitely**

Humalog

**take 1-2 Units before meals (or as directed)
adjust dose as outlined (see attached document), repeat indefinitely**

Blood glucose meter teststrips

**8 per day or as directed
3 months supply, repeat indefinitely**

Doctors Signature

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Adjustment of Lantus insulin

- Test your blood sugar every day before breakfast.
- Your target blood sugar before breakfast is between **5.0 & 8.0**
- Your starting dose of Lantus insulin is **10** units. Take your shot before breakfast
- If your blood sugar is higher than 8 **take 2 units more than you took yesterday.**
 - Example: You took 20 units of Lantus insulin yesterday. This morning your blood sugar is high at 9.2. This is above your target range. Today you should take 22 ($20 + 2 = 22$). 22 units is your new dose. If your sugar tomorrow is high or low the dose will change again.
- If your sugar before breakfast is less than 5 **take 4 units less than you took yesterday.**
 - Example: You took 20 units of Lantus insulin yesterday. Your blood sugar before breakfast is below target at 4.3. Today you should take 16 units ($20 - 4 = 16$). 16 units is your new dose. If your sugar tomorrow is high or low this dose will change again.
- If your sugar is between 5.0 and 8.0 **keep your dose the same as yesterday.**
 - Example: You took 20 units of Lantus insulin yesterday. Your blood sugar before breakfast is 5.9. This is within your target range. Today should take 20 units again today.

Practice Adjustments (assuming you start with 10 units of Lantus insulin)

<u>Day</u>	<u>Sugar before breakfast</u>	<u>Today's Dose</u>
Day One	13.0	12 (=10+2)
Day Two	11.4	14 (=12+2)
Day Three	10.2	16 (=14+2)
Day Four	8.6	18 (=16+2)
Day Five	6.3	18 (no change)
Day Six	5.8	18 (no change)
Day Seven	8.8	20 (=18+2)
Day Eight	3.8	16 (=20-4)
Day Nine	6.9	16 (no change)

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Rapid (mealtime) Insulin Adjustment

Attached above is a prescription for rapid (mealtime) insulin – this is taken by injection – the pharmacist will show you as to how to take it – below are instructions as to how you can adjust the dose of insulin.

- Test your blood sugar every day before dinner (and other meals) – this adjustment guide focuses on dinner shots though the same principles apply to other meals.

- Your target blood sugar before dinner is: 5-8. Note if your sugar is frequently >10 you may need to increase your basal insulin or take rapid insulin with lunch as well. If your sugar is <5.0 you may need decrease your basal insulin or if you are taking rapid insulin at lunch decrease the lunch-time dose. If your blood sugar is occasionally > 10 before dinner you may take extra rapid insulin as a “correction” - see below*

- Your target blood sugar 2 hours after dinner is: 6-10

- Your starting dose of rapid insulin (taken immediately before) dinner is 2 units.

- If your blood sugar 2 hours after dinner is below target **decrease your mealtime rapid insulin dose by 2 units before dinner tomorrow night.**

Example: You took 6 units of insulin before dinner. Two hours after dinner your blood sugar is below target at 4.8. Tomorrow before dinner you should take 4 units ($6 - 2 = 4$). Note 4 units before dinner becomes your new dose. If your blood sugar is <4.0 or if you are worried about going low later in the evening take a small snack now.

- If your blood sugar is **to target** (within the range written above) **keep your mealtime rapid insulin dose the same.**

Example: You took 6 units before dinner tonight. Your blood sugar two hours after dinner is 6. This is within your target range. Tomorrow night you should take 6 units again before dinner.

- If your blood sugar is **high** (above your target range) **increase your mealtime rapid insulin dose by 1 unit tomorrow night.**

Example: You took 6 units of rapid insulin before dinner. Two hours after dinner your blood sugar is high at 12.4. This is above your target range. Tomorrow night you should take 7 ($6 + 1 = 7$). Note 7 units before dinner becomes your new rapid mealtime insulin dose

Corrections* (if applicable)

If your blood sugar **before dinner** is 10.1 to 12.0 add an extra 1 unit of rapid insulin **only** for that night;

If it is 12.1 to 14.0 add an extra 2 units

If it is 14.1 to 16.0 add an extra 3 units

If it is 16.1 to 18.0 add an extra 4 units

If it is higher than 18.0 add an extra 5 units

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Carb counting

First you have to learn the carb values for common starchy foods – these can be obtained from a number of resources. A good place to start is <http://bcchildrens.ca/Services/SpecializedPediatrics/EndocrinologyDiabetesUnit/ForFamilies/DiabetesHandouts.htm#nutrition>

The next thing you need to figure out is how many grams of carbs it takes to neutralize the effect of one unit of mealtime insulin. This value is often called the “carb ratio”. People with Type 1 diabetes who are very sensitive to insulin may require as many as 15 grams of starch to neutralize one unit of mealtime insulin (ie their “carb ratio” is 15 to 1 or 15:1). The “average” Type 1 diabetic has a lower carb ratio, often close to 10 to 1. (note people with Type 2 diabetes often have much lower carb ratios, as low as 5 to 1 or even 2 to 1).

When you are starting out with carb counting, it is safe practice to assume your carb ratio is 15 to 1 – we choose a high starting carb ratio because we don’t want you to have a low sugar after your first dose! To find out your own carb ratio you will have to do a series of simple experiments with your favourite starchy foods.

A small bagel has 30 grams of starch. If your carb ratio is 15 to 1 and you plan to eat a bagel, you will need $30/15 = 2$ U of mealtime insulin to neutralize the carbs in a single bagel. The ultimate test of whether you got the dose of insulin right (based on carb counting and your carb ratio) is whether the sugar two hours after a meal is in the 6-10 range (or 8-12 one hour after a meal). This also assumes that your blood sugar before the meal started out in the right range (say 5-8). So if you ate the bagel and your sugar was > 10 two hours after the meal it means you didn’t take enough insulin and that your carb ratio is less than 15 to 1. Next time you eat the bagel you might want to try a carb ratio of 10 to 1 which would mean you would take $30/10 = 3$ units of ultra-short acting insulin. On the other hand if your blood sugar after the bagel was < 6 that implies you took too much insulin and your carb ratio is actually higher than you guessed. Note for American readers: to convert blood sugar values discussed in this article to American units multiply by 18.

Providing you are doing your carb counting correctly and your sugars after meals are good, your sugar values when you wake and before meals have much more to do with your dose of basal (baseline) insulin. Common once-daily basal insulins include insulin glargine (Lantus) and insulin detemir (Levemir). NPH is a basal insulin that is best taken twice daily (12 hours apart) in roughly equal doses. The dose of basal insulin is correct when your sugar when you wake and before meals is in the 5-8 range. If your pre-breakfast readings are consistently above 8 you probably need to increase your basal insulin dose. To be on the safe side you should check your sugar at 2:00 or 3:00 AM to make absolutely sure you are not low – some people have morning highs because they have asymptomatic 2:00 or 3:00 AM lows. If your pre-breakfast readings are consistently less than 5 you need to decrease your basal insulin dose.

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Laboratory Requisition

ORDERING MD —

CC: The Patient Clinic

PATIENT INSTRUCTIONS — get this blood test done on an empty stomach – preferably after an overnight fast – go to one of the following labs

- Lifelabs or BC Biomedical Labs
- if none of the above available in your area go to your local hospital laboratory

LAB TESTS REQUESTED — Standing Orders noted below "thru YYYY-MM-DD".

- A1c quarterly thru 2010-09-10
- Creatinine annually thru 2010-09-10
- Potassium annually thru 2010-09-10
- Urine Microalbumin/Creatinine Ratio annually thru 2010-09-10
- ALT annually thru 2010-09-10
- AST annually thru 2010-09-10
- CK annually thru 2010-09-10
- Major risk factor for CAD:**
- Cholesterol annually thru 2010-09-10
- Triglycerides annually thru 2010-09-10
- HDL Cholesterol annually thru 2010-09-10
- LDL Cholesterol annually thru 2010-09-10
- Chol/HDL (Risk Ratio) annually thru 2010-09-10
- TSH annually thru 2010-09-10

SIGNATURE M.D.

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Ministry of Health

HLTH 1548 Rev. 2005/05/16

CERTIFICATE OF TRAINING IN SELF BLOOD GLUCOSE MONITORING

This certificate authorizes the client to claim Blood Glucose Monitoring Strips as a benefit under PharmaCare.

Client Name: _____

Personal Health Number: _____

Term of Certification: _____ to _____
(yyyy/mm/dd) indefinite or yyyy/mm/dd

This information will be sent to PharmaCare by the Education Centre to confirm your eligibility for PharmaCare benefits.

I hereby consent to the release of this information to the Minister of Health, or his or her delegate. The information will be relevant to and used solely for the purpose of determining and administering my PharmaCare benefits under the *Continuing Care Act* of British Columbia. Provincially, the information will be protected in accordance with the *Freedom of Information and Protection of Privacy Act* of British Columbia.

signature of client

FOR FURTHER INFORMATION CONTACT:

VGH Diabetes Centre

Diabetes Education Centre