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Chapter 2

Life Begins to Change for Me

The day following my diagnosis of diabetes mellitus was a long and fatiguing one. I went to school until noon and then headed to Dr. Martin Draznin's office with mom. Dad arrived a little later after work.

Dr. Draznin talked about how most other youth newly diagnosed with diabetes went to the hospital for a week or two, to learn the physical skills they would need for the rest of their lives. All patients and their families are not the same, he told me. His experience as a pediatric endocrinologist had taught him that he needed to individualize diabetes care education to each family and

their needs. So he was going to start doing everything with me as an outpatient as he had with other young people. I was clearly not a guinea pig, and my family had confidence in his judgment.

Both Dr. Draznin and my parents thought I would be afraid; they found it odd that I was much happier that I did not have to spend a week or two in the hospital—that would have been another week or two out of an already shaky high school start. I was excited and felt unique to have gotten diabetes, but of course I did not know then what was fully involved.

During that long post-diagnosis day, September 28, 1993, I learned everything that I needed

in order to survive until my next visit. I was bombarded with information, techniques, and the consequences of having diabetes.

I learned first what causes diabetes mellitus. My pancreas was not producing enough insulin so that the food I ate was not being processed normally.

Instead of the digested food being stored as fuel for later use by my body, the simple sugars stayed in my bloodstream. And because my body was getting energy by burning stored fats, rather than food carbohydrates, ketones were building up there, too. Finally, both the sugar and ketones in my blood spilled into my urine during their passage through my kidneys. That accounted for my high blood sugar counts and the sugar and ketones that Dr. Feinberg had found in my urine.

Karyl Hare, the diabetes educator at the office, did most of the work in helping me. What a ton of information! First she explained the differ-

ent kinds of insulin medications I would need to buy and their very specific effects on my body. Then she showed me how to test my blood sugar with a glucometer, to draw up insulin into a syringe, to give myself insulin injections, and to read urine paper test strips. She taught me about glucometer readings of blood sugar levels and what the different levels mean. I was grateful that she was so patient with me and my parents.

My body, like yours, can't sense any difference in the insulin produced by a pancreas from insulin bottled by pharmaceutical companies and bought at the drug store. This is all so basic to me now, but at the time my head was spinning and I felt completely overwhelmed.

All that information took a long time to communicate and even start to sink into my head. My blood sugar level was 585 mg/dl before I received my first insulin shot. I particularly remember being extremely drowsy and almost falling asleep immediately before the injection.

We were in the office seven hours. During this time I also spoke to the dietitian, Susan Larner, but she spoke mostly with my mom. Dr. Draznin spoke mostly with my dad. The doctor and dietician spoke with me as well, but I was concentrating on how to do the basic things that Karyl had taught me. I thought they were the most important at that stage.

When I left the office, crowded in front of my mind was all I had been taught to do, but in the back of my mind was the haunting fear of

what my first insulin reaction was going to feel like. They had mentioned "unconscious" and "glucagon injection," both of which really caught my attention. That evening my family went to dinner at Elias' Brothers Big Boy restaurant, and I came home feeling much stronger. I hit the sack all ready for school the next day (or so I thought).

NOTES

Have you ever wondered how the medical professionals on TV shows can respond so quickly to urgent situations? In real life it is because of two factors—*principles* (of anatomy, physiology, and chemistry) and *practice* (through many opportunities to apply those principles). Although body fluid testing may seem complicated at first, take it step by step. Soon you will be a "pro" too!

BODY FLUID TESTING

Blood Testing

1. Have clean hands. Use an alcohol swab.

2. Get blood to the fingers by rubbing hands together, running them under warm water, or "milking" the blood in the finger. Squeeze the finger between the hand and the tip.

3. Use an Ultra-Fine™ lancet, one with a very sharp but thin cutting point.

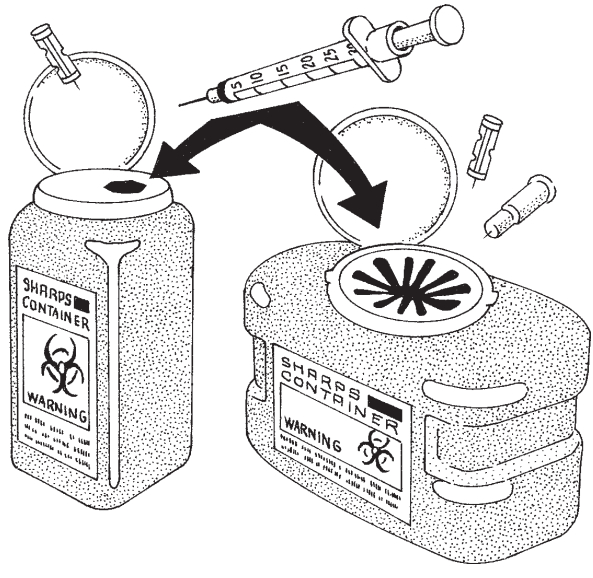
Lancets, in blade or needle forms, are meant for pricking the skin. They are individually packaged inside protective plastic caps in quantities of 100-200 per box by many manufacturers and distributors. Most fit into more than one of several brands of ergonomic lancing devices, like, Penlet®, Glucolet®, Hemaletô, Dialetô, Softclix®. They allow handling the pricking tool with ease and safety. Sold separately, these devices range in price from $15-$35, while the average retail cost for lancets is less than nine cents each.

4. Make finger poke on the outside of the finger tip. Avoid the pad of your finger with its many nerve endings.

5. Quickly put blood drop on strip. Exposure to air may give false high counts.

6. Firmly press site with clean tissue while your glucometer is calculating the test result.

Although shelf prices range from $20-$120 for various glucometer styles with digital readouts and a wide range of computational functions, rebates are widespread. Rebates and trade-ins on new instruments come as coupon offers from local pharmacies, hospital supply companies, and e-commerce firms. Some kits include lancing devices. All manufacturers include toll-free phone numbers to connect buyers with customer service representatives to help in emergency medical situations or to explain the proper use of this tool. Your doctor and nurse can help you choose the right meter—remember, diabetes care is personal and individualized—and train you to use it properly.



7. Dispose of the lancet in a Sharps container or in a compartment of your testing kit until a Sharps container is available. Do this at least to keep from cutting yourself and to protect others from any blood-borne disease you may have. Sharps containers are labeled “biohazard” because a disease agent that threatens to harm humans may have contaminated the used lancets or needles you put into them.

Urine Testing

1. Dip test strip in urine; or for less hassle, place the strip in the urine stream.

2. Read substance levels at the exact times recommended on the container.

Screening the urine for critical substances can be done with reagent strips ("dipsticks") or with reagent tablets. *Reagents* are chemical substances that cause a very specific chemical reaction to occur in the presence of certain other substances. They serve to detect, measure, examine, or produce other substances. Reagents that change color are *chromagens*, from Greek words meaning "color producers," and when their color changes indicate how much of a substance is present, they are *colormetric* or "color measurers."

Although urine testing kits for glucose and/or ketones are still commonly available in drug stores, most health care professionals recommend them **only** for ketones to avoid accidents. Sometimes patients have mistakenly used a urine glucose strip when thinking they were testing for ketones. Their calls for instruction for taking extra insulin to bring the reading down resulted in too much insulin producing severe hypoglycemia.

An unconventional use for urine glucose strips is for testing sauces and soft drinks to verify that they really don't have sugar in them. Eating out could be a problem: if drinks get mixed up, results can be drastic. Just test yours to be sure. If the strip turns dark green, the food contains sugar. Always carrying a bottle of strips with you is inexpensive insurance.

Other dangers are possible with urine glucose tablets. They can cause serious burns if toddlers ingest them. Keep your family life simple—use urine tests for ketones only, and blood tests for sugar levels.

SUBSTANCE TESTS IN BLOOD AND URINE

You know the power of color if you have tinkered with a chemistry set at home, used food coloring to dye Easter eggs, or dyed your hair. Chemistry makes use of that knowledge and is the foundation for substance tests.

Blood Sugar Levels

The digital readouts on the glucometer will show how much glucose is in your blood. Read the number and mentally add the metric unit label mg/dl. Here is what these amounts mean:

Over 240 mg/dl	Needs attention NOW
160 to 240 mg/dl	Needs attention Change routine tomorrow
120 to 160 mg/dl	Bears watching Not unusual after meals
80 to 120 mg/dl	Ideal—target range
65 to 80 mg/dl	Low but safe
60 to 65 mg/dl	Low Danger of hypoglycemia
Below 60 mg/dl	Too low Hypoglycemia

A drop of blood positioned on a blood test strip is all a battery-operated glucometer needs to calculate the weight of glucose in a deciliter of whole blood (less than 3.5 fluid ounces or not even as much liquid as a small juice glass holds). Laboratory levels above 65 mg/dl plasma glucose are safe, and many meters measure whole blood glucose which is lower than plasma glucose by 12%.

Hooking a blood test strip into a glucometer puts your drop in contact with a reagent-soaked pad that must be kept dry before use. Bottles of reagent strips are capped with silica gel to absorb function-destroying moisture; they should be kept out of the refrigerator, but not above a temperature of 86˚ Fahrenheit. These strips in an opened and capped bottle have a shelf-life of about four months.

Reagent-pad ingredients in blood test strips include the enzymes glucose oxidase and peroxidase. Words ending with -ase are usually enzymes; they always break something down. Glucose oxidase functions the same way whether it is working inside your body or on a reagent pad. It combines with oxygen in the air to break down glucose, producing gluconic acid and some peroxide (the same substance you may have used to bleach your hair or disinfect a scraped knee). Peroxidase reacts with the peroxide and acid produced in the first half-reaction, breaking them down to mostly water and causing the reagent pad to change color.

Urine Sugar Levels

The normal amount of glucose in urine is less than or equal to 0.3 g over 24 hours, effectively a negative reading in both adults and children. In insulin-dependent diabetics, a negative urine test result could correspond to a wide range of blood glucose levels. Glucose in urine, or *glucosuria*, usually occurs when the blood glucose level is greater than 180-200 mg/dl. Both urination and thirst increase at these levels.

People spill sugar into their urine at different blood sugar levels, so the meaning of a urine sugar test is often confusing. Urine test results may be misleading, while home blood glucose monitoring is more accurate.

Urine Ketone Levels

Urine ketones appear in the urine when body tissue, particularly fat, is being broken down for energy because not enough food has been eaten or not enough insulin is present

to help the body burn sugar.

- A trace reading means body tissues are beginning to be burned for energy. Normally sugar would be the energy source.
- The higher the readings, the longer and more severe the abnormal *metabolism* has been occurring. In other words, your body has been burning its own tissues for a long time when it should have been burning sugar. This can be very damaging to you.

Ketone build-up in the body can cause a medical emergency, ketoacidosis, that can produce unconsciousness and may require hospitalization. Urine ketones must be detected early before this crisis occurs—something easily accomplished by self-testing methods at home or away. If results show moderate or large amounts of ketones present, call your doctor or diabetic educator immediately!

Ketone checks are needed under any one of these conditions, according to Dr. H. Peter Chase:

1. New diagnosis of diabetes — Check twice daily or more often if urine ketones are positive. If all ketone checks during the first two weeks are negative, discontinue them.

2. One insulin injection per day — Check morning urine ketones to find out if your insulin is lasting a full 24 hours.

3. Morning blood sugars vary between very high and very low — Check morning urine ketones to find out if your blood sugar is "rebounding" or "bouncing" after a low during the night. Your body responds to these lows by releasing two hormones (adrenaline and glucagon) to raise the blood sugar level. These hormones can put ketones in the urine.

4. High blood sugars — Check urine ketones if your blood sugar is more than 240 mg/dl.

5. Anytime a diabetic feels sick — Check urine

ketones especially if vomiting occurs. When sickness develops, ketones can be present even if the blood sugar is **not** high.

Urine Ketone Test Strips

Two strips most frequently used are Ketostix® and Chemstrip®K. They differ primarily in how long the fresh urine is exposed to reagent before you read the color change results, according to the color blocks printed on the package insert. Mental counting is not good enough. Accurate timing to the second is necessary. Ketostix® requires exactly 15 seconds; Chemstrip®K, 60 seconds.

Individual foil-wrapped test strips are better, although more expensive, than bottles of test strips because they are reliable for a longer time. The foil wrapping prevents their exposure to moisture in the air. Their expiration date may be two years from the time they were packaged, instead of six months.

Urine Ketone Tablets

Accurate timing is also crucial to reading Acetest® tablet results; 30 seconds is necessary. Tablet color changes are gradations of purple.

INSULIN INJECTIONS

How much insulin to inject is based on body weight and the results of blood sugar tests. The right dose starts with measuring the insulin in units, where 100 units has the volume of 1 cc. Dosage usually starts at one-fourth unit per pound (0.25 U/lb) or one-half unit per kilogram (0.5 U/kg). It may go up to 1 U/kg or 1 unit every 2 lb.

In rapidly growing adolescents however, insulin doses about 1U/kg are not unusual. The higher level of growth hormone circulating through a teen's body causes an increased need for insulin. Growth hormone is a counter

regulatory hormone that protects against low blood sugar when fasting, for example, during nighttime sleep.

Regardless of the amount needed, use these steps to inject your insulin:

1. Clean the tops of insulin bottles with alcohol swab.

2. Acquire a sterilized syringe.

3. Draw up desired dose by injecting the same amount of units of air into each bottle for the units of insulin to be drawn out of that bottle. Remember to not allow air bubbles into the syringe by keeping the needle tip submerged in the insulin.

Draw up the short-acting insulins first, such as Humalog® or Regular. Then be sure that the long-acting insulins are mixed adequately by rolling the bottle gently. Draw up the longer-acting insulins second, whether NPH, Lente®, or Ultralente®.

4. Clean the site of injection with alcohol swab and then let it air dry. Do not blow on the site to speed up the drying time. That can add germs to the site.

5. Pinch up the *subcutaneous tissue* found just underneath the skin of the chosen site. Be sure to *rotate the injection sites*, that is, choose a different site than either your previous injection or your next one in a regular pattern you can remember.

By rotating the site, the previous site heals from a past shot and can be reused over and over throughout life. Suggestions for managing site rotation are to focus on one large area, for example, the thigh, and within that large area use as many separate sites as possible while keeping the injections no closer to each other than one and a half inches.

6. While pinching the subcutaneous tissue with a non-dominant hand, hold the syringe like a pen in the dominant hand. Thrust the needle completely, all the way up to its hilt, into the site. To avoid more pain than necessary, do this step quickly. If the needle is first touched to the skin and then injected slowly, a stinging pain can result.

Keep in mind that you will only feel the needle go

through your skin. Once past the skin, you won't feel it. Pinching your flesh will make it hard to feel the needle at all. If you do hit a nerve occasionally, you will feel it right away so you can choose another site immediately.

7. Once the needle is completely in, relax the squeezed tissue and get ready to inject the insulin.

8. Injecting the insulin should be done slowly. Put in approximately five units; wait a few seconds. Then put in five more and wait a few more seconds, and so on. This helps preserve the site and, even though the needle is in the skin longer, it is actually less painful.

9. When all the insulin has been injected, pull the needle straight out, cap it, and dispose of it properly, most likely into a Sharps container.

As newspaper readers of Ann Landers' columns should know, insulin injections can occur unobtrusively in public places. Often nobody sitting at the same restaurant table even notices. There is no need to pull up one's shirt and expose skin. Diabetics can inject right through clothing. However, doing this can lead to strange tattoos as pieces of cloth get trapped under the skin. Another possible consequence is that newer, very thin needles may bend or break off in the skin if they are handled roughly.

Injection Review

- Sterilize the bottle cap.
- Obtain the syringe.
- Draw up the insulin.
- Choose a site and clean it.
- Pinch up skin.
- Insert needle quickly.
- Relax the tissue
- Inject insulin slowly.
- Remove and cap the needle.
- Dispose of the needle properly.