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Type 1 Diabetes

Type 1 diabetes is the type of diabetes that typically develops in children and young adults. In type 1 diabetes the body stops making insulin and the blood sugar (glucose) level goes very high. Treatment to control the blood glucose level is with insulin injections and a healthy diet. Other treatments aim to reduce the risk of complications and include reducing blood pressure if it is high, and to lead a healthy lifestyle.

What is diabetes?

Diabetes mellitus (just called diabetes from now on) occurs when the level of sugar (glucose) in the blood becomes higher than normal. There are two main types of diabetes. These are called type 1 diabetes and type 2 diabetes.

What is type 1 diabetes?

This is also known as juvenile, early-onset, or insulin-dependent diabetes. It usually first develops in children or young adults. In the UK about 1 in 300 people develop type 1 diabetes at some stage.

With type 1 diabetes the illness usually develops quite quickly, over days or weeks, as the pancreas stops making insulin. It is treated with insulin injections and a healthy diet (see below).

Why does the pancreas stop making insulin?

In most cases, type 1 diabetes is thought to be an autoimmune disease. The immune system normally makes antibodies to attack germs called bacteria and viruses, and also other germs. In autoimmune diseases the immune system makes antibodies against part or parts of the body. If you have type 1 diabetes you make antibodies that attach to the beta cells in the pancreas. These are thought to destroy the cells that make insulin. It is thought that something triggers the immune system to make these antibodies. The trigger is not known but a popular theory is that a virus triggers the immune system to make these antibodies.

Rarely, type 1 diabetes is due to other causes. For example, severe inflammation of the pancreas, or surgical removal of the pancreas for various reasons.

What is type 2 diabetes?

This is also known as maturity-onset, late-onset, or non-insulin-dependent diabetes. Type 2 diabetes usually develops after the age of 40 (but sometimes occurs in younger people). It is more common in people who are overweight or obese.

With type 2 diabetes, the illness and symptoms tend to develop gradually (over weeks or months). This is because in type 2 diabetes you still make insulin (unlike type 1 diabetes). However, you either do not make enough for your body's needs, and/or the cells in your body are not able to use insulin properly. This is called insulin resistance.

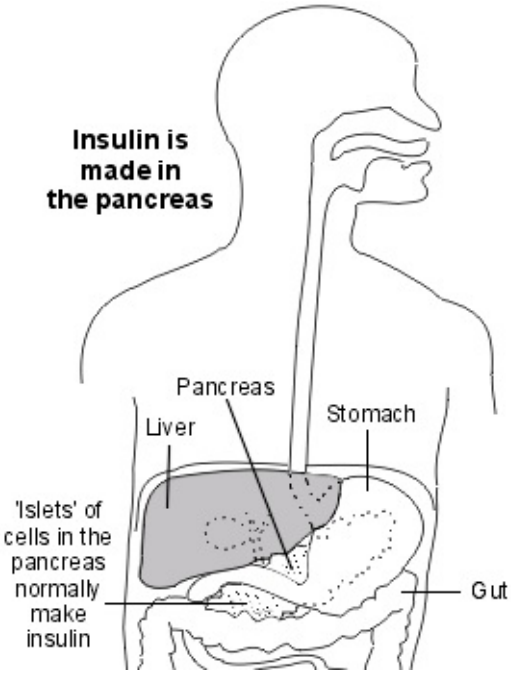
Understanding blood glucose and insulin

After we eat, various foods are broken down into sugars in the gut (intestine). The main sugar is called glucose. This is absorbed through the gut wall into the bloodstream. Glucose is like a fuel which is used by the cells in the body for energy. To remain healthy, your blood glucose level should not go too high or too low.

So, when your blood glucose begins to rise (after eating), the level of a hormone called insulin should also rise. Insulin acts on the cells of your body and makes them take glucose into the cells from the bloodstream. Some of the glucose is used by the cells for energy, and some is converted into stores of energy (glycogen or fat). When the blood glucose level begins to fall (between meals or when we have no food), the level of insulin falls. Some glycogen or fat is then broken down back into glucose and some is released back into the bloodstream to keep the blood glucose level normal.

Hormones such as insulin are chemicals that are released into the bloodstream and have an action on certain parts of the body. Insulin is made by special cells called beta cells which are part of little islands of cells (islets) within the pancreas.

Diabetes develops if you do not make enough insulin, or if the insulin that you do make does not work properly on the body's cells.



The rest of this leaflet deals only with type 1 diabetes. There is a separate leaflet called Type 2 Diabetes.

What are the symptoms of type 1 diabetes?

The symptoms that usually occur when you first develop type 1 diabetes are:

- You are very thirsty a lot of the time
- You pass a lot of urine
- Tiredness, weight loss, and feeling generally unwell

The above symptoms tend to develop quite quickly, over a few days or weeks. After treatment is started, the symptoms soon settle and go. However, *without treatment*, the blood sugar (glucose) level becomes very high and acids form in the bloodstream (ketacidosis). If this persists you will become lacking in fluid in the body (dehydrated), and are likely to lapse into a coma and die. (The reason you make a lot of urine and become thirsty is because glucose leaks into your urine, which pulls out extra water through the kidneys.)

How is diabetes diagnosed?

A simple dipstick test can detect sugar (glucose) in a sample of urine. This may suggest the diagnosis of diabetes. However, the only way to confirm the diagnosis is to have a blood test to look at the level of glucose in your blood. If this is high then it will confirm that you have diabetes. Some people have to have two samples of blood taken and they may be asked to fast (this means having nothing to eat or drink, other than water, from midnight before the blood test is performed).

Is type 1 diabetes inherited?

Although type 1 diabetes is not an inherited disease, there is some genetic factor. A first-degree relative (sister, brother, son, daughter) of someone with type 1 diabetes has about a 6 in 100 chance of developing type 1 diabetes. This is higher than the chance of the general population, which is about 1 in 300. This is probably because certain people are more prone to developing autoimmune diseases such as diabetes, and this is due to their genetic make-up, which is inherited.

What are the possible complications of diabetes?

Very high blood sugar (glucose) level

If you are not treated, or use too little insulin, a very high blood glucose level can develop quite quickly - over several days. If left untreated this causes lack of fluid in the body (dehydration), drowsiness, and serious illness which can be life-threatening. A very high blood glucose level sometimes develops if you have other illnesses such as any infections. In these situations you may need to adjust the dose of insulin to keep your blood glucose level normal.

Long-term complications

If the blood glucose level is higher than normal, over a long period of time, it can have a damaging effect on the blood vessels. Even a mildly raised glucose level which does not cause any symptoms in the short term can affect the blood vessels in the long term. This may lead to some of the following complications (often years after diabetes is first diagnosed):

- Furring or hardening of the arteries (atheroma) which can cause problems such as angina, heart attacks, stroke and poor circulation.
- Eye problems which can affect vision. This is due to damage to the small arteries of the retina at the back of the eye.
- Kidney damage which sometimes develops into kidney failure.
- Nerve damage.
- Foot problems. These are due to poor circulation and nerve damage.
- Impotence. Again, this is due to poor circulation and nerve damage.
- Other rare problems.

The type and severity of long-term complications varies from case to case. You may not develop any at all. In general, the nearer your blood glucose level is to normal, the less your risk of developing complications. Your risk of developing complications is also reduced if you deal with any other risk factors that you may have such as high blood pressure.

Treatment of complications

Too much insulin can make the blood glucose level go too low (hypoglycaemia, sometimes called a 'hypo'). This can cause you to feel sweaty, confused, and unwell, and you may lapse into a coma. Emergency treatment of hypoglycaemia is with sugar, sweet drinks, or a glucagon injection (a hormone which has the opposite effect to insulin). Then you should eat a starchy snack such as a sandwich.

What are the aims of treatment?

Although diabetes cannot be cured, it can be treated successfully.

If a high blood sugar (glucose) level is brought down to a normal or near-normal level, your symptoms will ease and you are likely to feel well again. However, you still have some risk of complications in the long term if your blood glucose level remains even mildly high - even if you have no symptoms in the short term. Studies have shown that people who have better glucose control have fewer complications (such as heart disease or eye problems) compared with those people who have poorer control of their glucose level.

Therefore, the main aims of treatment are:

- To keep your blood glucose level as near to normal as possible.
- To reduce any other risk factors which may increase your risk of developing complications. In particular, to reduce your blood pressure if it is high, and to lead a healthy lifestyle.
- To detect any complications as early as possible. Treatment can prevent or delay some complications from getting worse.

Treatment aim 1 - keeping your blood glucose level near normal

How is the blood sugar (glucose) level monitored?

It is likely you will need to monitor your glucose levels by using a monitor at home. If you check your blood glucose level, ideally you should aim to keep the level between 4 and 7 mmol/L before meals, and less than 9 mmol/L two hours after meals.

It may be best to measure your blood glucose level at the following times:

- At different times in the day
- After a meal
- During and after vigorous sport or exercise
- If you think you are having an episode of low blood glucose (hypoglycaemia)
- If you are unwell with another illness (for example, a cold or infection)

Another blood test is called HbA1c. This test measures a part of the red blood cells. Glucose in the blood attaches to part of the red blood cells. This part can be measured and gives a good indication of your blood glucose control over the previous 1-3 months. This test is usually done regularly by your doctor or nurse. Ideally, the aim is to maintain your HbA1c to less than 48 mmol/mol (6.5%). However, this may not always be possible to achieve and your target level of HbA1c should be agreed between you and your doctor.

Insulin

To stay well and healthy you will need insulin injections for the rest of your life. Your doctor or diabetes nurse will give a lot of advice and instruction on how and when to take the insulin. Insulin is not absorbed in the gut (intestine) so it needs to be injected rather than taken as tablets. There are various types of insulin. The type or types of insulin advised will be tailored to your needs.

The six main types of insulin are:

- **Rapid-acting analogue** - can be injected just before, with or after food. It tends to last between 2 and 5 hours and only lasts long enough for the meal at which it is taken.
- **Long-acting analogue** - is usually injected once a day to provide background insulin lasting approximately 24 hours.
- **Short-acting insulin** - should be injected 15-30 minutes before a meal, to cover the rise in blood glucose levels that occurs after eating. It has a peak action of 2-6 hours and can last for up to 8 hours.
- **Medium-acting and long-acting insulin** - are taken once or twice a day to provide background insulin or in combination with short-acting insulins/rapid-acting analogues. Their peak activity is between 4 and 12 hours and can last up to 30 hours.
- **Mixed insulin** - is a combination of medium-acting and short-acting insulin.
- **Mixed analogue** is a combination of medium-acting insulin and rapid-acting analogue.

Most people take 2-4 injections of insulin each day. The type and amount of insulin you need may also vary each day, depending on what you eat and the amount of exercise you do.

Insulin pumps

Insulin pump therapy continually infuses insulin into the layer of tissue just beneath the skin (the subcutaneous tissue). Insulin pumps work by delivering a varied dose of fast-acting insulin continually throughout the day and night, at a rate that is pre-set according to your needs.

An insulin pump involves a lot of work and requires a high level of motivation from the person using it. These pumps are not suitable for everyone with type 1 diabetes. Your doctor will be able to discuss this with you in more detail.

Alternatives to injecting insulin

There has been plenty of research done in recent years to develop ways to administer insulin other than by injection. These have included insulin nasal and oral sprays, patches, tablets and inhalers. After many years of work, some of the methods being researched are showing a degree of success. However, it will be some time before any of these devices will be available to people with diabetes in the UK.

Healthy diet

You should eat a healthy diet. This diet is the same that is recommended for everyone. The idea that you need special foods if you have diabetes is a myth. Diabetic foods still raise blood glucose levels, contain just as much fat and calories and are usually more expensive than non-diabetic foods. Basically, you should aim to eat a diet low in fat, salt and sugar and high in fibre and with plenty of fruit and vegetables. However, you will need to know how to balance the right amount of insulin for the amount of food that you eat. Therefore, you will normally be referred to a dietician for detailed advice.

Balancing insulin and diet, and monitoring blood glucose levels

Monitoring your blood glucose level will help you to adjust the amount of insulin and food according to the level and your daily routine.

Treatment aim 2 - to reduce other risk factors

You are less likely to develop complications of diabetes if you reduce any other risk factors. These are briefly mentioned below, but are discussed more fully in the separate leaflet called Preventing Cardiovascular Diseases. Everyone should aim to cut out preventable risk factors, but people with diabetes have even more of a reason to do so.

Keep your blood pressure down

It is very important to have your blood pressure checked regularly. The combination of high blood pressure and diabetes is a particularly high risk factor for complications. Even mildly raised blood pressure should be treated if you have diabetes. Medication, often with two or even three different drugs, may be needed to keep your blood pressure down. See separate leaflet called Diabetes and High Blood Pressure.

If you smoke - now is the time to stop

Smoking is a high risk factor for complications. You should see your practice nurse or attend a smoking cessation clinic if you have difficulty stopping smoking. If necessary, medication or nicotine replacement therapy (nicotine gum, etc) may help you to stop.

Do some physical activity regularly

Regular physical activity also reduces the risk of some complications such as heart and blood vessel disease. If you are able, a minimum of 30 minutes' brisk walking at least five times a week is advised. Anything more vigorous is even better - for example, swimming, cycling, jogging, dancing. Ideally you should do an activity that gets you at least mildly out of breath and mildly sweaty. You can spread the activity over the day (for example, two fifteen-minute spells per day of brisk walking, cycling, dancing, etc).

Other medication

Depending on your age and how long you have had diabetes, you may be advised to take a medicine to lower your cholesterol level. This will help to lower the risk of developing some complications such as heart disease and stroke.

Try to lose weight if you are overweight or obese

Excess weight is also a risk factor for heart and blood vessel disease. Getting to a perfect weight is often unrealistic. However, if you are overweight, losing some weight will help.

Some of these lifestyle issues may not seem to be relevant at first to young children who are diagnosed as having diabetes. However, as children grow, a healthy lifestyle should be greatly encouraged for the long-term benefits.

Treatment aim 3 - to detect and treat any complications

Most GP surgeries and hospitals have special diabetes clinics. Doctors, nurses, dieticians, specialists in foot care (chiropodists), specialists in eye health (optometrists), and other healthcare workers all play a role in giving advice and checking on progress. Regular checks may include:

- Checking levels of blood glucose, HbA1c, cholesterol and blood pressure.
- Ongoing advice on diet and lifestyle.
- Checking for early signs of complications; for example:
    - Eye checks - to detect problems with the retina (a possible complication of diabetes) which can often be prevented from getting worse. Increased pressure in the eye (glaucoma) is also more common in people with diabetes, and can usually be treated.
    - Urine tests - these include testing for protein in the urine, which may indicate early kidney problems.
    - Foot checks - to help to prevent foot ulcers.
    - Blood tests - these include checks on kidney function, and other general tests. They also include checks for some autoimmune diseases which are more common in people with diabetes. For example, coeliac disease and thyroid disorders are more common than average in people with type 1 diabetes.

It is important to have regular checks, as some complications, particularly if detected early, can be treated or prevented from getting worse.

Immunisation

You should be immunised against flu (each autumn) and against infection from pneumococcal germs (bacteria) (just given once). These infections can be particularly unpleasant if you have diabetes.

Further help & information

JDRF - Juvenile Diabetes Research Foundation

19 Angel Gate, City Road, London, EC1V 2PT

Tel: 0207 713 2030

Web: www.jdrf.org.uk

Diabetes UK

Macleod House, 10 Parkway, London, NW1 7AA

Tel: (Careline) 0845 120 2960 (Admin) 0207 424 1000

Web: www.diabetes.org.uk

Further reading & references

- Diagnosis and management of type 1 diabetes in children, young people and adults; NICE Clinical Guideline (July 2004)
- Diabetes; NICE
- Management of diabetes; Scottish Intercollegiate Guidelines Network - SIGN (March 2010)
- Global Guideline for Diabetes in Childhood and Adolescence; International Diabetes Federation and International Society for Pediatric and Adolescent Diabetes (2011)
- Diabetes - type 1; NICE CKS, Dec 2010
- Driving and diabetes; Diabetes UK
- Diabetes and High HbA1c Information Prescription; Diabetes UK
- Diabetes and High Cholesterol Information Prescription; Diabetes UK

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