Impaired Glucose Tolerance

If you have impaired glucose tolerance, your blood glucose is raised beyond the normal range but it is not so high that you have diabetes. However, if you have impaired glucose tolerance you are at risk of developing diabetes. You are also at risk of developing cardiovascular disease (heart disease, peripheral vascular disease and stroke). If impaired glucose tolerance is treated, it can help to prevent the development of diabetes and cardiovascular disease. The most effective treatment is lifestyle changes including eating a healthy balanced diet, losing weight if you are overweight, and doing regular physical activity.

Understanding blood glucose and insulin

After you eat, various foods are broken down in your gut into sugars. The main sugar is called glucose which passes through your gut wall into your bloodstream. However, to remain healthy, your blood glucose level should not go too high or too low.

So, when your blood glucose level begins to rise (after you eat), the level of a hormone called insulin should also rise. Insulin works on the cells of your body and makes them take in glucose from the bloodstream. Some of the glucose is used by the cells for energy, and some is converted into glycogen or fat (which are stores of energy).

When the blood glucose level begins to fall (between meals), the level of insulin falls. Some glycogen or fat is then converted back into glucose which is released from the cells into the bloodstream.

Insulin is a hormone that is made by cells called beta cells. These are part of little islands of cells (islets) within the pancreas. Hormones are chemicals that are released into the bloodstream and work on various parts of the body.

What is a normal blood glucose level?

Your blood glucose level literally refers to the amount of glucose in your blood. A normal blood glucose level ranges between about 4 and 8 millimoles per litre (mmol/L). Blood glucose levels may be at the higher end of the range after eating and at the lower end of the range first thing in the morning.

If your blood glucose is measured by a blood test when you have not been fasting, this is called a random blood glucose level. If your blood glucose is measured after you have been fasting, this is called a fasting blood glucose level. A normal fasting blood glucose level is less than 6 mmol/L.

Note: the terms blood sugar and blood glucose mean the same thing.
What is diabetes?

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

The World Health Organization has said that someone may have diabetes if they have:

- A fasting blood glucose of 7 mmol/L or more, OR
- A blood glucose 11.1 mmol/L or more after a 2-hour oral glucose tolerance test (GTT) (see below).

Type 1 diabetes

In type 1 diabetes the beta cells in the pancreas stop making insulin. The illness and symptoms develop quickly (over days or weeks) because the level of insulin in the bloodstream becomes very low. Type 1 diabetes used to be known as juvenile, early onset, or insulin-dependent diabetes. It usually first develops in children or in young adults. Type 1 diabetes is treated with insulin injections and diet. See separate leaflet called 'Diabetes Type 1' for more details.

Type 2 diabetes

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 in type 1 diabetes). However, you develop diabetes because:

- You do not make enough insulin for your body's needs, OR
- The cells in your body do not use insulin properly. This is called insulin resistance. The cells in your body become resistant to normal levels of insulin. This means that you need more insulin than you would normally make to keep the blood glucose level down, OR,
- A combination of the above two reasons.

See separate leaflet called 'Diabetes Type 2' for more details.

What is impaired glucose tolerance?

If you have impaired glucose tolerance, your blood glucose is raised beyond the normal range but it is not so high that you have diabetes. However, if you have impaired glucose tolerance you are at risk of developing type 2 diabetes. In fact, some people call impaired glucose tolerance pre-diabetes.

Between 1 to 3 out of 4 people with impaired glucose tolerance will develop diabetes within ten years.

It is also thought that having impaired glucose tolerance increases your risk of developing cardiovascular disease (that is, heart disease, peripheral vascular disease and stroke). Also, people who have impaired glucose tolerance are more likely to also have other risk factors for cardiovascular disease, including high blood pressure, raised cholesterol levels, being overweight, etc. (See separate leaflets called 'Preventing Cardiovascular Diseases' and 'Cardiovascular Health Risk Assessment', which give further details about cardiovascular disease and its risk factors.)

The World Health Organization has said that someone has impaired glucose tolerance if they have:

- A fasting blood glucose of less than 7 mmol/L, AND
- A blood glucose of 7.8 mmol/L or more but less than 11.1mmol/L after a 2-hour oral GTT (see below).
What is impaired fasting glycaemia?

The World Health Organization has also said that someone has impaired fasting glycaemia if they have:

- A fasting blood glucose between 6.1 to 6.9 mmol/L, AND
- A blood glucose of less than 7.8 mmol/L after a 2-hour oral GTT (see below).

If you have impaired fasting glycaemia, you are also thought to have an increased risk of developing diabetes, although this is a little lower than those with impaired glucose tolerance. Also, even though still increased, your risk of developing cardiovascular disease seems to be lower than if you have impaired glucose tolerance. The rest of this leaflet is about impaired glucose tolerance.

How common is impaired glucose tolerance?

Many people have impaired glucose tolerance and because there are no symptoms, they do not know that they have it. Diabetes UK estimate that around seven million people in the UK have impaired glucose tolerance.

What causes impaired glucose tolerance and who gets it?

Impaired glucose tolerance develops for the same reasons as type 2 diabetes (see above). There are various things that can increase your risk of developing impaired glucose tolerance. They are the same risk factors as those for type 2 diabetes. They include:

- Being overweight or obese (most people with impaired glucose tolerance are overweight or obese).
- Having a family history of diabetes. This refers to a close family member with diabetes - a mother, father, brother or sister.
- Doing little physical activity.
- Having other risk factors for cardiovascular disease such as high blood pressure or high cholesterol levels.
- If a woman has polycystic ovary syndrome and is also overweight.
- If you developed diabetes during pregnancy (called gestational diabetes).

What are the symptoms of impaired glucose tolerance and how is it diagnosed?

People with impaired glucose tolerance usually have no symptoms. You are often found to have impaired glucose tolerance after blood tests taken for another reason show that you have a raised blood glucose level. Sometimes, your doctor may suggest that a screening blood test should be taken to check your blood glucose because they are worried that you may have some risk factors for impaired glucose tolerance or diabetes. For example, if you have high cholesterol levels, are overweight, have high blood pressure, or if you have had a heart attack or stroke, your doctor may suggest that you have a blood test to check your blood glucose.

If your blood glucose level is raised, your doctor may then suggest that you have a GTT to see if you have impaired glucose tolerance.

Having a glucose tolerance test

A GTT checks how well your body processes glucose. It involves comparing the levels of glucose in your blood before and after drinking a sugary drink.

In healthy people, glucose levels in the blood always rise after a meal but they soon return to normal as the glucose is used up or stored. A GTT helps to distinguish between this
normal pattern and the patterns seen in diabetes and impaired glucose tolerance.

You are asked not to eat for a certain length of time before a GTT. Your fasting blood glucose level is checked by a blood test just before the test. Then you drink a sugary drink and another blood test is taken two hours after the drink to measure your blood glucose levels again. Normally, your body should quickly move glucose from your blood into your body's cells. If there is a problem moving glucose into the cells, glucose remains in the bloodstream. This shows as a higher level of glucose in the second blood sample.

When the results of the blood samples come back, doctors compare the level of glucose found in your blood sample taken after the test with specific values. These values can determine if you have diabetes or impaired glucose tolerance.

For further details, see separate leaflet called 'Glucose Tolerance Test'.

How is impaired glucose tolerance treated?

There is increasing evidence that if impaired glucose tolerance is treated, the progression to diabetes can be prevented. Also, it may be possible to prevent cardiovascular disease from developing. So, it is important to know if you have impaired glucose tolerance and to treat it in order to reduce your risk of developing diabetes and cardiovascular disease. Treatments that have been suggested include lifestyle changes and drug treatments.

Lifestyle changes
Lifestyle changes have been found to be the most effective way to stop impaired glucose tolerance from developing into diabetes. Losing weight if you are overweight and increasing your levels of physical activity can help to reduce insulin resistance and therefore make the insulin that is produced more effective at controlling your blood glucose levels.

If you have impaired glucose tolerance, you should:

- **Eat a healthy balanced diet.** Your practice nurse and/or a dietician will give details on how to eat a healthy diet. The diet is the same as recommended for everyone. The idea that you need special foods if you have impaired glucose tolerance or diabetes is a myth. Basically, you should aim to eat a diet low in fat, high in fibre and with plenty of starchy foods, fruit and vegetables. See separate leaflet called 'Healthy Eating', which gives further details.
- **Lose weight if you are overweight.** Getting to a perfect weight is unrealistic for many people. However, if you are obese or overweight then losing some weight will help to reduce your blood glucose level (and have other health benefits too). See separate leaflet called 'Weight Reduction - How to Lose Weight', which gives further details.
- **Do some physical activity regularly.** If you are able, a minimum of 30 minutes' physical activity at least five times a week is advised. For example, walking, 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 15-minute spells per day of brisk walking, cycling, dancing, etc.) Regular physical activity also reduces your risk of having a heart attack or stroke. A separate leaflet called 'Physical Activity For Health' gives further details. Always check with your doctor that it is safe to start exercising if you have been inactive for a long period.

There are also other lifestyle changes that you can make to reduce your cardiovascular disease risk. These include:

- Stop smoking if you are a smoker.
- Ensuring that you stick to the recommended alcohol intake. (Please see separate leaflet called 'Recommended Safe Limits of Alcohol' for details.)
Also, make sure that your blood pressure stays within the normal range. Get your blood pressure checked regularly with your practice nurse.

Also, discuss with your doctor or practice nurse if you need a cholesterol check and/or treatment to lower your cholesterol level.

**Drug treatments**

A number of medical trials have looked at the use of various drug treatments for people with impaired glucose tolerance to see if they can help to prevent diabetes and cardiovascular disease. There are several more trials which are ongoing. Drugs that have been, or are being, trialled include metformin, acarbose, a group of drugs called ACE inhibitors and another group of drugs called angiotensin II receptor antagonists.

However, the results from a big study, including more than 9,000 people from 40 different countries, have recently been published in the New England Journal of Medicine. The study looked at two drugs - one that lowers blood pressure (called valsartan) and one that lowers blood sugar (called nateglinide), and whether they could be used to stop the development of diabetes and cardiovascular disease in people with impaired glucose tolerance. The results showed that there was not a big difference in how many people went on to develop diabetes when prescribed either of these drugs compared with a placebo (dummy) drug. They also showed that neither of the drugs seemed to prevent cardiovascular disease in people with impaired glucose tolerance.

So, at the moment, many experts feel that lifestyle changes are the most important thing if you are found to have impaired glucose tolerance.

**What follow-up is needed if you have impaired glucose tolerance?**

If you are found to have impaired glucose tolerance, it is important that you be followed up regularly by your doctor. This will usually mean a blood test to check your fasting blood glucose level at least once a year. This is to make sure that you have not developed diabetes. Your doctor is also likely to keep a check on any other risk factors that you may have for cardiovascular disease. So, they may monitor your weight, your blood pressure and also suggest a blood test to check your cholesterol and triglyceride levels.

In the meantime, if you develop any symptoms of diabetes, you should visit your doctor sooner. Symptoms include: excess thirst, passing large amounts of urine, tiredness, weight loss, and feeling generally unwell. Symptoms tend to develop quite slowly, over weeks or months.

**Can impaired glucose tolerance be prevented?**

The same things that can help prevent type 2 diabetes can help prevent impaired glucose tolerance. These include:

- Eating a healthy balanced diet.
- Losing weight if you are overweight.
- Doing some physical activity regularly.

**References**

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