Keywords Type 1 diabetes/Diagnosis/Long-term conditions

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In this article...

- The clinical features of type 1 diabetes
- How type 1 diabetes is diagnosed
- An explanation of the risk factors for type 1 diabetes

Type 1 diabetes: overview, diagnosis and risk factors

Key points

Type 1 diabetes can be life threatening if it is left untreated

A minority (around 8%) of the population who have diabetes have type 1 diabetes

People living with type 1 diabetes must have insulin

Diabetic ketoacidosis can be the first presentation of the condition

Type 1 diabetes cannot be prevented or cured

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Abstract An estimated 8% of people with diabetes have type 1 diabetes. An autoimmune condition, it is primarily managed with insulin but can lead to a rapid deterioration in health and wellbeing. This article – one of two on type 1 diabetes – aims to make nurses aware of the clinical features of diabetes. It also explores how type 1 diabetes is diagnosed and outlines the risk factors, and considers some common myths about the condition.

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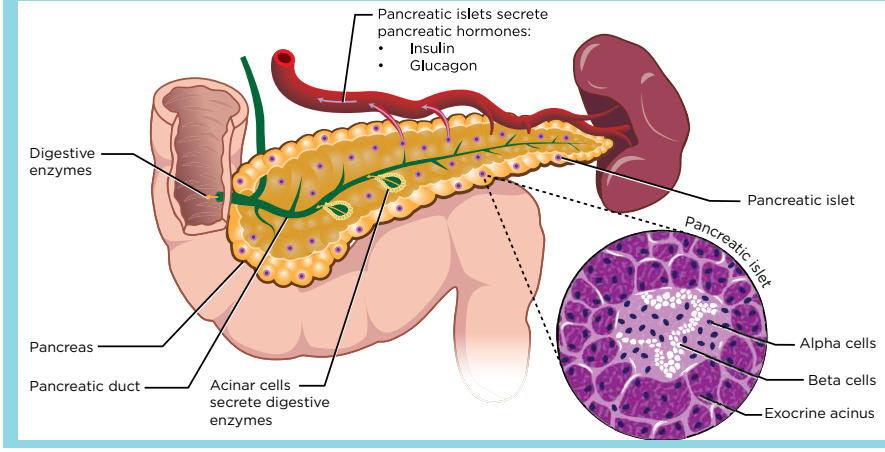
Diabetes is a prevalent long-term condition. It has been estimated that, in the UK, >5 million people have it (Diabetes UK, nda), while approximately 400,000 people are living with type 1 diabetes in the UK (Juvenile Diabetes Research Foundation, 2023). Type 1 diabetes has historically been known as 'juvenile diabetes', with the thought being that it is diagnosed at a young age. There are estimated to be >36,000 children or young adults aged <18 years living with diabetes in the UK, and around 90% of them have type 1 diabetes (Diabetes UK, 2019).

General nurses can have limited exposure to the management of type 1 diabetes as it is much less common than type 2 diabetes. Because a greater level of specialist knowledge is needed for nurses to care for people with type 1 diabetes, patients are mostly supported in secondary care by specialist diabetology teams.

This article looks at the clinical features of type 1 diabetes, how it is diagnosed and its risk factors.

Fig 1. **Structure of the pancreas**



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What is type 1 diabetes?

Type 1 diabetes has been defined as "a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces" (World Health Organization (WHO), 2023). People living with type 1 diabetes need daily administration of insulin to survive; without this, the condition will be fatal.

It is estimated that around 8% of those who have diabetes in the UK have type 1 diabetes (Diabetes UK, 2019). The highest prevalence of type 1 diabetes is among people aged 35-60 years in the UK (National

Institute for Health and Care Excellence (NICE), 2023). It is further estimated that around 90% of children (aged <18 years) in the UK who have a diabetes diagnosis have type 1 diabetes (NICE, 2023).

Why does it occur?

Type 1 diabetes is an autoimmune condition in which the body releases antibodies that stop insulin production by beta cells in the pancreas (DiMeglio et al, 2018). To regulate blood glucose in the body, insulin is released from the pancreas when we eat, and this lowers the blood glucose level. In the absence of insulin, the blood glucose levels in the body begin to rise to abnormal levels (Hantzidiamantis and Lappin, 2022).

Table 1. **Clinical features of type 1 diabetes**

Symptom	Reason
Polydipsia (excessive thirst)	The body tries to reduce sugar levels by passing more urine. The person drinks more to replace lost fluid
Polyuria (increased urine output)	The body tries to reduce sugar levels by passing more urine
Polyphagia (increased appetite)	The body is unable to use glucose effectively and the person feels hungry
Tiredness and irritability	The process that converts glucose into adenosine triphosphate and provides energy to the cells is affected. High blood sugar prevents the body drawing on reserves of glycogen in the liver
Fungal infections	High sugar levels in blood and tissues increase infection risks
Poor wound healing	High sugar levels affect the circulation and slow wound healing
Ketones present	Acid produced by the liver when fat is turned into energy

Source: Nazarko (2010)

The function of the pancreas

The pancreas (Fig 1) is located in the first curve of the duodenum and is responsible for digestive and glucose regulation. These are also known as:

- The exocrine function of the pancreas – this is when digestive enzymes that promote normal digestion and absorption of nutrients are released (Ghodeif and Azer, 2023).
- The endocrine function of the pancreas – islet cells known as insulin are made, which regulate blood glucose (Taylor and Knight, 2021).

In type 1 diabetes, antibodies destroy the production of islet cells, but the exocrine function remains intact.

Clinical features of type 1 diabetes

With type 2 diabetes, the clinical features are insidious and may be unnoticed; with type 1 diabetes, however, the onset of clinical features is more rapid and more likely to be noticed by the patient. The clinical features of diabetes are similar between the different types, but some people may not experience all of these features and/or have different intensities, which can be why they can go unnoticed. Table 1 outlines the clinical features of type 1 diabetes.

What can lead to a diagnosis?

Diabetic ketoacidosis

Diabetic ketoacidosis (DKA) is a serious complication of diabetes that can be life threatening. It is more commonly seen in type 1 diabetes and can be the first presentation of the condition (Joint British Diabetes Societies for Inpatient Care, 2023). Nurses working in emergency departments may see people present to hospital with DKA as their first presentation of diabetes.

DKA develops when the body does not have enough insulin to allow glucose to be used as energy. As a consequence, the liver begins to break down fat cells to be used as energy and, when this happens, acids known as ketones are produced. Ketones can be smelt on the breath or tested by a ketone meter. High levels of ketones in the body can be very dangerous and, if left untreated, fatal (Centers for Disease Control and Prevention, 2022).

DKA is a medical emergency and should be treated immediately. The patient should be admitted to hospital, where they will be treated. Depending on the presenting condition, a DKA pathway may be used. This involves intravenous fluids and intravenous insulin. In the UK, around 4% of people living with type 1 diabetes experience DKA each year (Misra and Oliver, 2015).

Diagnosing type 1 diabetes

NICE's (2022) guidance recommends testing for diabetes if a person has one or more of the following clinical features:

- Rapid weight loss – unexplained weight loss can occur rapidly over a couple of weeks or months. This is due to the inability of glucose in the blood cells to provide energy, so the body finds an alternative way to gain energy by burning fat and muscle. As a result of this, ketones can be produced;
- Ketosis – ketones are a biproduct of the process of fat or muscle being turned into energy. High levels of ketones can be fatal and, if left untreated, will result in DKA (Nall, 2022);
- Family history – when making any diagnosis, it is essential to gather as much information as possible considering family history of diabetes or other autoimmune diseases. There is a heritable component in both types of diabetes, so this may help to make the diagnosis in the light of gathered information (Hill and Oliver, 2020);
- Body mass index (BMI) – typically people living with type 1 diabetes will have a lower BMI than those who have type 2 diabetes, particularly at diagnosis, with likely recent weight loss;
- Age – age can be used to help diagnose type 1 diabetes. Typically, type 1 diabetes has been diagnosed at a younger age than type 2 diabetes. However, age should not be used as a key indicator because it is possible to be diagnosed with type 1 diabetes at any age.

Diagnostic tests

An HbA1c blood test measures the amount of glucose attached to red blood cells (haemaglobin), and is commonly used to diagnose both types of diabetes. When the body has higher levels of glucose, more glucose will stick to the red blood cells. In most people, red blood cells remain in the body for 2-3 months, until the spleen produces new ones. For this reason, an HbA1c test should only be repeated every three months if needed; if it is repeated before this time, the result may be similar to that of the previous test (Diabetes UK, ndb).

The WHO's (2020) threshold for a diagnosis of diabetes is an HbA1c level of >48mmol/mol. To conclude the diagnosis of type 1 diabetes, further blood tests are recommended to check for antibodies and the extent of the pancreas's functionality – namely, glutamic acid decarboxylase autoantibodies (GAD) and anti-islet cell antibody tests.

The presence of GAD antibodies is seen

in around 75% of people with type 1 diabetes (diabetes.co.uk, 2023). Meanwhile, islet cell antibodies are seen in around 95% of people with type 1 diabetes; however, this test can be time sensitive, as antibodies can disappear soon after diagnosis (Lab Tests Online UK, 2020).

As well as these blood tests, a C-peptide blood test can be used to measure the pancreatic beta-cell function. A low C-peptide result can also indicate type 1 diabetes (Leighton et al, 2017).

Understanding risk factors

Risk factors for type 1 diabetes are not as clear as they are for type 2 diabetes. There are known risk factors that can increase the chance of developing type 1 diabetes, such as a family history of an autoimmune disease, such a coeliac disease, Graves' disease or type 1 diabetes. Family history risk can be high or low, depending on the side of the family from which the risk comes – this is outlined in Table 2.

Other risk factors can include injury to the pancreas, exposure to illness caused by a virus, and physical stress. In the US, it has been observed that White people appear to be more susceptible to developing type 1 diabetes than African-Americans and Hispanic-Americans (Smith-Marsh, 2016). Further to this, Chinese ethnicity has been shown to result in a lower risk of developing type 1 diabetes (Smith-Marsh, 2016).

There is currently no known prevention for type 1 diabetes, but there is ongoing research into the immune system to stop beta cells from being attacked (Diabetes UK, ndb).

Type 1 diabetes and genetics

There are different types of genes that can be linked to type 1 diabetes. These genes are mapped in the human leukocyte antigen (HLA) class II. People carrying the HLA class II gene account for 30-50% of type 1 diabetes risk (Lee and Hwang, 2019). Specifically, HLA-DR3 or HLA-DR4 are found in the White population. People with other ethnicities, such as African-Americans, have the gene HLA-DR7; HLA-DR9 has been seen in people of Japanese ethnicity, which can also put them at risk (American Diabetes Association, nd).

Myths about type 1 diabetes

Over the years, the presentation, management and treatment for type 1 diabetes has developed significantly, but many myths about type 1 diabetes still remain. This can affect care delivery and be very stigmatising for people living with the condition.

A common myth about type 1 diabetes is that it develops as a child. It is more commonly diagnosed in childhood, but can be diagnosed at any age.

There is a strong emphasis on weight management in diabetes care, which is often directed towards people living with type 2 diabetes. Living without overweight or obesity would not prevent the development of type 1 diabetes. In type 1 diabetes, losing weight can help with insulin resistance, but it would not cure the condition and insulin treatment would still be needed.

Diabetes is often associated with sweets and sugary foods. Such foods will elevate the blood glucose levels but, as long as the person living with type 1 diabetes has the right dose of insulin, there should be little negative impact. There are no foods that people living with type 1 diabetes should not eat and no special diet to which they should adhere; like everyone else, they need a healthy, balanced diet.

Foods that are branded as being 'diabetic' often contain high amounts of fat and are not necessarily good for people who are living with diabetes to eat.

Conclusion

Type 1 diabetes is a complex long-term condition that affects a minority of the population that has diabetes. This article has given an overview of how it develops and how it is diagnosed. Understanding the clinical features of diabetes can help nurses to identify it early and initiate treatment to avoid harm or fatal consequences for the affected individual. **NT**

● The second article in this series will explore the treatment and management of type 1 diabetes, and provide an in-depth examination of insulin

Table 2. Genetic risk from parents and siblings

Relationship to person with type 1 diabetes	Risk of developing type 1 diabetes
Father	1 in 17
Mother	1 in 100
Both parents with type 1	1 in 4
Sibling	1 in 17
Twin	1 in 2

Source: Adapted from Moore (2023)

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Resources

Joint British Diabetes Societies for Inpatient Care publications:

- *The Management of Diabetic Ketoacidosis in Adults*
- *Nursing Management for Diabetic Ketoacidosis (DKA) Supplement*