Management of type 1 diabetes



What is type 1 diabetes?

Type 1 diabetes is an autoimmune condition (body's immune system turning against itself to cause damage) where the Islets of Langerhans (insulin secreting cells in the pancreas) are targeted by the body's immune system and causes relative or absolute destruction of the islet cells and a dire lack of insulin secretion. The damage is usually permanent unless the process is identified early and specific treatment can be provided to arrest the autoimmune response. This treatment strategy is still relatively new and it is difficult to identify people who have not yet developed symptoms but where the autoimmune process has started to cause damage.

How does type 1 diabetes present?

Type 1 diabetes usually presents with rapid weight loss, and the 3 Ts – increased fatigue or Tiredness, feeling excessive Thirst, frequent urination (Toilet) and with rapid weight loss. In some instances, this leads to an acute serious illness called diabetic ketoacidosis (DKA) where acid builds up in the body due to lack of insulin and is characterised by lethargy, nausea, vomiting, abdominal pain and the symptoms above.

How is type 1 diabetes treated?

The cornerstone of treatment in type 1 diabetes is insulin given through a drip if very unwell and admitted to hospital or through regular insulin injections given under the skin. Understanding key components of the diet including identification of foods containing carbohydrates (simple and complex sugars and starches) is essential to managing the condition appropriately.

Blood glucose monitoring

The main stay of treatment is maintenance of blood glucose levels between a range of 4 mmol/l and 10 mmol/l majority of the time. Glucose monitoring is vital in managing diabetes (especially type 1 diabetes) and until recently people with type 1 diabetes had to prick their fingers to obtain blood to measure blood glucose levels with a glucometer. Devices that measure glucose levels in the interstitial fluid (fluid that is found in between cells) under the skin continuously and feed this information to a smartphone or connected meter are now available and are called continuous glucose monitoring (CGM) devices. A CGM sensor once inserted can usually last between 7 and 15 days depending on the type of device and provides glucose data across the 24 hour period which has helped revolutionise diabetes care.

Different types of insulin

Given that people with type 1 diabetes can no longer produce insulin, they must take insulin from external sources. Insulin has been manufactured in the lab for many decades and comes in different forms based on the preparation which allows for variable duration of action lasting between 4 hours and beyond 24 hours. Depending on the rapidity of absorption and duration of action, insulin can be classified into ultra-rapid, rapid, intermediate, long acting and ultra-long acting insulins.

There are several types of insulin in use:

• Ultra-rapid and rapid-acting insulin - starts working within 15 minutes and lasts for 3-5 hours. Used to cover meals or to correct high blood glucose.

- Short-acting insulin takes about 30 minutes to start working and lasts 5-8 hours.
- Intermediate-acting insulin takes 1-2 hours to begin working and lasts for 12-16 hours. Often used as a basal (background) insulin.
- Long-acting insulin provides a steady level of insulin over 24 hours or more and is used as a basal insulin. Helps control blood glucose levels in between meals and overnight.
- Pre-mixed insulin: A combination of rapid and intermediate acting insulin types in a specific ratio (usually 30:70) can be found in pre-mixed insulins which allows for twice daily administration.

Typical insulin regimens to cover the 24-hour period are multi-dose insulin (MDI or basal-bolus) regimens and twice daily (pre-mix) regimens. The former involve more injections (usually 3-5 times/day) but offer more flexibility and control and the latter usually consist of 2 injections daily but need a more fixed regimen of eating and insulin use.

Insulin can be administered via insulin injections, insulin pens and insulin pumps.

Insulin pumps and hybrid closed loop technology

These are small devices which can be filled with rapid acting insulin and which can be programmed to deliver insulin at specific rates (basal) across the 24-hour period via a cannula that sits in the skin. Additionally, a quick burst of insulin (bolus) can be given at mealtimes by the user. These devices offer more flexibility in changing the amount and timing of insulin delivery which improves flexibility of self-care of diabetes. Typically, the pump cannula or pod has to be changed every 3 days and re-filled with insulin. Over the last few years, a combination of pump and sensor technology with algorithm-based insulin delivery has allowed the development of hybrid closed loop systems which are a step towards "artificial pancreas" and can help achieve excellent blood glucose control whilst reducing the risk of hypoglycaemia (low sugars).

Diet and carbohydrate counting

Diet plays a key role in managing blood sugar levels. People with type 1 diabetes need to:

- Count carbohydrates carbohydrates have the largest impact on blood glucose levels. People need to know how much insulin they need to match the amount of carbs they are consuming.
- Eat balanced meals meals should contain a mix of carbohydrates, proteins, and fats to help maintain stable blood glucose levels.
- Avoid swings in blood glucose big and sudden changes in glucose readings can cause symptoms and difficulties in managing diabetes and have negative consequences. Proactive self-care and prompt action is needed to maintain appropriate blood glucose levels.

Exercise and physical activity

Regular exercise is important for overall health and can help improve insulin sensitivity, which makes it easier to manage blood glucose levels. However, exercise can affect blood glucose and adjustments to insulin doses or carbohydrate intake may be needed before, during, or after physical activity.

Managing hypoglycemia (Low blood sugar)

Hypoglycemia is a common side-effect of treatment in people with type 1 diabetes, especially if insulin doses are too high, meals are skipped, or exercise is more intense than expected. Symptoms may include shakiness, dizziness, confusion, and sweating. Treatment typically involves consuming fast-acting carbohydrates, such as glucose tablets or sugary drinks, to quickly raise blood glucose levels.

Continuous monitoring of health

People with type 1 diabetes should regularly see their healthcare team to monitor:

- Glycated haemoglobin (HbA1c) levels This test is a measure of average blood glucose levels over the preceding 2-3 months. The target for most adults with type 1 diabetes is usually below 53mmol/mol. However, individualised targets are set based on age, health conditions, pregnancy etc.
- Kidney function Diabetes can affect kidney health over time, so regular screening is important and is by means of blood and urine checks at least annually.
- Eye health Annual eye checks are recommended to detect diabetic retinopathy, a potential complication of diabetes.
- Blood pressure and cholesterol levels These should be monitored as diabetes increases the risk of cardiovascular disease.
- Foot care People with diabetes should take good care of their feet and take prompt action if any injuries are sustained. Regular foot specialist care may be needed.

Education and support

• Managing type 1 diabetes requires a programme of education for newly diagnosed individuals with ongoing support from a specialist team comprised of diabetes specialists, diabetes nurses, podiatrists and other specialists in some cases. Understanding the impact of lifestyle choices, insulin management, and how to respond to blood sugar fluctuations is critical.

Advanced treatments in selected individuals

Islet cell transplantation and whole pancreas transplantation from deceased donors can be carried out but requires lifelong immune suppressing medication use, which carries its own risks. Therefore, such treatment is reserved for a the most complicated cases of type 1 diabetes and those who may need kidney transplantation due to end stage diabetic kidney disease.

Research into potential new treatments and technologies for type 1 diabetes is ongoing. Some promising developments include:

- Fully artificial pancreas Systems that combine insulin pumps and continuous glucose monitoring to automatically adjust insulin delivery for both basal and bolus insulin.
- Stem cell therapy Trials are exploring how stem cells might be used to regenerate insulin-producing cells in the pancreas.
- Immunotherapy Investigating ways to prevent or stop the immune system's attack on insulin-producing cells.
- Encapsulated islets: These are specially designed to evade the immune system and therefore obviate the need for immunosuppressive therapies.

Summary

Type 1 diabetes is primarily treated with insulin therapy, regular blood glucose monitoring, a balanced diet, appropriate exercise, and regular medical check-ups. Managing the condition requires care and collaboration with healthcare providers to adjust insulin doses and lifestyle routines to maintain stable blood glucose levels and prevent complications.