

Diabetes Mandatory Training

Pre-Reading Document



What is Diabetes?

Glucose (sugar) in the blood is too high because the body does not produce any or enough of the hormone insulin.

Insulin is produced in the pancreas and is central to the metabolism of carbohydrates and in the control of blood glucose.

There are 2 main types of Diabetes:

Type 1 Diabetes

- This is when your body does not produce any insulin at all.
- It is an autoimmune disease. It happens when the body's own immune system attacks and destroys the cells in the pancreas, and, as a result, the pancreas stops making insulin.
- Insulin is the main treatment for type 1 diabetes, this will be lifelong and should never be stopped.
- Although it's often diagnosed in childhood or young adulthood, people can develop type 1 diabetes at any age.

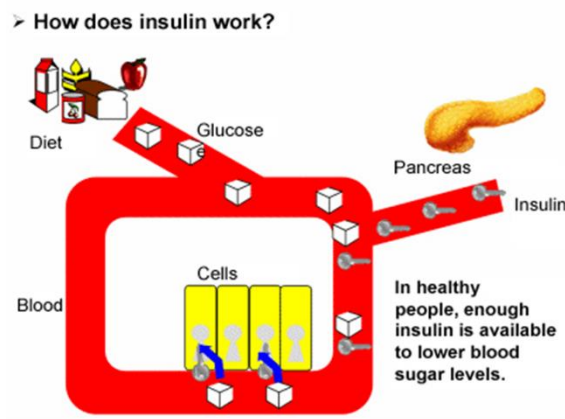
Type 2 Diabetes

- This is when you have either increased insulin resistance or inadequate insulin production
- There are a wide range of treatments including, diet and lifestyle, tablets, injectables and insulin
- Often occurs when people are overweight or obese
- Usually occurs over the age of 40.

What all types of diabetes have in common is that glucose (sugar) cannot get into the cells properly, so it begins to build up in the blood.

We all need some glucose, as this is what gives us energy. We get glucose when our bodies break down the carbohydrates that we eat and drink, and that glucose is released into our blood. The body then utilises a hormone called insulin, which is made by our pancreas, to allow the glucose in our blood to enter our cells and fuel our bodies (the 'lock and key' analogy).

If you do not have diabetes, your pancreas senses when glucose enters your blood stream and releases the right amount of insulin, so the glucose can get into your cells. But if you have diabetes this system does not work.



Symptoms of diabetes:

Both types:

- *Passing urine more frequently, especially at night (Polyuria).*
- *Feeling extremely thirsty (Polydipsia).*
- *Feeling more tired than usual.*
- *Blurred vision.*
- *Cuts and wounds take longer to heal.*

Type 1:

- *Losing weight without trying to.*
- *Abdominal pain.*
- *'Pear drop' breath (? DKA).*

Type 2:

- *Repeated infections, especially fungal, genital itching and thrush.*
- *Increased hunger.*

OR THEY COULD BE ASYMPTOMATIC!

Diabetes complications:

High blood glucose levels over a long period of time can affect your heart, kidneys, eyes and feet.

With the right treatment and care people with diabetes can live a healthy lifestyle and there is a reduced risk of them experiencing these complications.

High glucose levels in time will damage your blood vessels, the more damaged these blood vessels get, the blood cannot travel to the parts of your body it needs to.

We monitor diabetic patients overall glycaemic control using a blood test called a 'HbA1c'. HbA1c is glycated haemoglobin. This is made when glucose sticks to your blood cells and builds up in your blood. It is measured by a blood test that shows your average blood glucose level over the last 3 months. A high HbA1c means you have too much glucose in your blood.

The higher your HbA1c level, the more you are at risk of developing complications.

Chronic complications:

These are long-term problems that can develop gradually and can lead to serious damage if they go unchecked and untreated.

- *Eye problems (Retinopathy)*
- *Foot problems*
- *Heart attack and stroke*
- *Kidney problems (Nephropathy)*
- *Nerve damage (Neuropathy)*
- *Gum disease and mouth problems*
- *Related conditions like cancer*
- *Sexual problems in women*
- *Sexual problems in men*

Acute complications:

- *Hypoglycaemic episode (HYPOS – low capillary blood glucose levels <4mmol/L)*
- *Hyperglycaemic episode (HYPER – high capillary blood glucose levels >14mmol/L)*
- *Hyperosmolar Hyperglycaemic States (HHS)*
- *Diabetes Ketoacidosis (DKA)*

DKA – Diabetic Ketoacidosis:

- **DKA is a serious complication of diabetes that is life threatening.**
- DKA develops when your body doesn't have enough insulin to allow glucose from your blood into your cells for use as energy.
- The body then burns fat for energy instead.
- This causes ketones to be released.
- Ketones build up and cause your blood to become acidic.
- Predominantly occurs in type 1 diabetes but can occur in type 2 diabetes.

It can be caused due to; a new onset/diagnosis of diabetes, missing insulin doses (accidentally or purposefully), trauma (surgery or illness), infection (chest, UTI, Flu, Sepsis), growth spurt from puberty, raised CBGs caused by menstrual cycle, steroid use, binge drinking, pregnancy or illegal drug use.

Symptoms include:

- Feeling tired/lethargic.
- Confusion.
- Blurred vision.
- Stomach pain.
- Nausea/vomiting.
- Polyuria.
- Polydipsia.
- Sweet smelling urine (nail varnish/pear drop sweets)
- Raised Capillary Blood Glucose (CBG) levels.
- Raised Capillary Blood Ketones (CBK) levels.
- Weight loss.
- Raised ketones and glucose in urine.
- Passing out.

Diagnosis:

- DIABETES - Serum blood glucose $>11.0\text{mmol/L}$ and/or known history of diabetes. Beware of euglycemic DKA in patients on SGLT-2 inhibitors with CBG $<11\text{mmol/L}$.
- KETONES - Ketones of $>3.0\text{mmol/L}$ or more than 2+ on urine dip.
- ACIDOSIS - $\text{HCO}_3^- <15\text{mmol/L}$ and/or venous PH of <7.3 .
- Any of the following may indicate severe DKA, consider ITU support if ketones $>6.0\text{mmol/L}$, $\text{HCO}_3^- <5$, PH <7.0 , Kcl <3.5 , GCS <12 , SBP <90 , Sats $<92\%$, pulse $<60/>100$
- CONSIDER PREGNANCY TEST.
- **ALWAYS confirm diagnosis before treatment.**
- **ALWAYS refer to Diabetes Outreach Team (DOT) via Sunrise system.**
- **ALWAYS continue long-acting insulin.**

Treatment:

- Commence treatment as soon as possible or within 30 minutes of diagnosis.
- Use policy "Diabetes Ketoacidosis Management in Adults Guideline".
- Commence Fixed Rate Insulin Infusion (FRII) with IV fluids.

Fixed Rate Insulin Infusion (FRII):

- Must be prescribed on Sunrise.
- 50 units Actrapid (0.5ml) in 50ml normal saline.
- **ALWAYS use an insulin syringe to draw up actrapid.**
- Dose is weight based. Fixed rate of 0.1 unit/kg/hr (max initial rate 15units/hr).
- Use original chart (not a photocopy)
- IV fluids as per policy (on reverse of FRII chart)
- When glucose falls below 14, give 10% glucose (continue saline).

- Consider potassium replacement (again see reverse of chart).
- Slower fluids in young people, elderly, pregnant, heart or renal failure (any concerns, modify the rate as necessary).
- If CBG falls quickly (>6.0 mmol/l/hr, reassess fluid and insulin rate rate).
- Monitor Capillary Blood Glucose and Capillary Blood Ketones hourly.
- Monitor PR, BP, RR, Sats, GCS, Venous HCO₃, PH and Kcl at 60 minutes, 2 hours and 2 hourly thereafter.
- 6 to 24 hours - Assess for improvement. Assess for complications (fluid overload, cerebral oedema).
- If not resolved by 24 hours, seek further advice.

The aim of a FRII is to; reduce capillary blood ketones by 0.5mmol/L per hour OR increase venous bicarbonate by 3.0mmol/L per hour OR reduce CBG by 3.0mmol/L per hour.

Potassium should be maintained between 4.0-5.5mmol/L. If CBK not falling by at least 0.5mmol/L/hr, increase rate by 1 unit/hr.

If CBG is <4.0 , temporarily reduce insulin rate to 0.5 units/hr, consider increasing 10% glucose rate and reducing normal saline. Seek senior advice.

Resolution:

- Resolution is achieved when CBK <0.6 mmol/L, and venous PH is >7.3 mmol/L and/or venous HCO₃ >18 .
- If patient is eating and drinking, give usual subcutaneous fast acting insulin with meal and stop FRII 1 hour later.
- If patient is not eating and drinking, switch to Variable Rate Insulin Infusion (VRII).
- When FRII/VRII stopped, continue hourly monitoring for minimum 2 hours then return to usual monitoring regime. Check ketones if CBG >15 (or any concerns).

Variable Rate Insulin Infusion (VRII):

- Must be prescribed on Sunrise.
- 50 units Actrapid (0.5ml) in 50ml normal saline.
- **ALWAYS use an insulin syringe to draw up actrapid.**
- Use original chart (not a photocopy)
- Dose is based on the relevant scale. Start with scale A unless patient is usually on a total daily dose of >80 units insulin.
- IV fluids as per policy (also on reverse of VRII chart)
- When glucose falls below 14mmol/L, commence 0.18%/4% dextrose.
- Consider potassium replacement (see chart).
- Slower fluids in young people, elderly, pregnant, heart or renal failure (any concerns, modify the rate as necessary).
- If Capillary Blood Glucose (CBG) in green, consider whether the VRII needs to continue.
- If 3 x CBGs in Amber, call doctor to consider changing scale.

- If CBG <4.0 mmol/L (Red), stop VRII, treat as per hypoglycaemia guidelines. When treated, restart VRII, Doctor to consider changing scale.
- If CBG >14 mmol/L (purple), call doctor to consider changing scale.
- If decision has been made to stop VRII, give usual subcutaneous fast acting insulin or usual oral diabetes medications with meal and stop VRII 30 mins later.
- **When FRII/VRII stopped, continue hourly monitoring for minimum 2 hours then return to usual monitoring regime. Check ketones if CBG>15 (or any concerns).**

Considerations: IN PREGNANCY – If ketones >1.0mmol/L, treat as DKA, if ketones >3.0mmol/L will require ITU review and Diabetes Consultant review.

HHS – Hyperosmolar Hyperglycaemic State:

- **HHS is a serious complication of diabetes that is life threatening.**
- Severe hyperglycaemia with hyperosmolarity, without evidence of ketosis.
- Severe hyperglycaemia draws fluid out of cells causing dehydration.
- There's enough insulin to prevent ketosis but not enough to reduce Capillary Blood Glucose levels (CBG).
- Patients with HHS are complex and often have co-morbidities so require intensive monitoring.
- Predominantly patients with Type 2 diabetes, usually middle aged or elderly.
- 15% mortality rate.

It can be caused due to; the patient not knowing they are diabetic (this may lead to diagnosis of diabetes), poor diabetes control, self-neglect, infection (cellulitis, sepsis, dental infections etc), myocardial infarction, stroke, hyper/hypothermia, pancreatitis, acute kidney injury (AKI), burns, hyperthyroidism, some medications, alcohol and drugs.

Symptoms include:

- Polyuria.
- Polydipsia.
- Nausea.
- Dry skin.
- Drowsiness.
- Gradual loss of consciousness.
- Hypovolaemia.
- Severe hyperglycaemia.

Diagnosis:

- Hypovolaemia.
- Marked hyperglycaemia (30mmol/L or more) without significant hyperketonaemia or acidosis (ketones <3.0mmol/L and pH >7.3 or bicarbonate >than 15mmol/L).

- Osmolarity 320 or more. (Calculate osmolarity with the following equation: $(2 \times \text{Na}^+) + \text{urea} + \text{serum glucose}$)
- ALWAYS refer to Diabetes Outreach Team (DOT) via Sunrise system.
- Any problem with intravenous access, request critical care support immediately.
- **ALWAYS give long-acting insulin.**

Treatment:

- Continue usual S/C insulin.
- Use policy "Hyperosmolar Hyperglycaemic State Management Guideline".
- Consider admission to high dependency area, if: Osmolarity >350 , sodium >160 , pH <7.1 , hypokalaemia (<3.5 mmol/L) or hyperkalaemia (>6 mmol/L), GCS <12 , O2 sats $<92\%$, SBP <90 , pulse >100 or <60 , output <0.5 ml/kg/hr, creatinine >200 , hypothermia, MI, Stroke, serious co-morbidity.
- IV 0.9% saline first to restore circulating volume and reverse dehydration. Only switch to 0.45% saline if the osmolarity is not declining despite adequate positive fluid balance.
- An initial rise of sodium is expected.
- Fall of plasma sodium should not exceed 10mmol/L in 24 hours.
- Fall of blood glucose should not exceed 5mmol/L/hr.
- Low dose IV insulin FRII (0.05 units/kg/hr) when blood glucose is not falling with IV fluids alone (after 2nd bag) OR immediately if ketones above 1.0 mmol/l.
- Continue IV fluid replacement to achieve positive fluid balance of 3-6 hours by 12 hours.
- Assess foot risk score.
- Minimum hourly monitoring for 6 hours then 2 hourly if response satisfactory.
- Continuous pulse oximetry and cardiac monitoring.
- Urinary catheter and fluid balance to monitor strict input and output.
- Ensure early senior review and diabetes team review.
- Consider Hypo/hyperkalaemia (less common in HHS than DKA but monitoring and replacement are essential).

Fixed Rate Insulin Infusion (FRII):

- 50 units Actrapid (0.5ml) in 50ml normal saline.
- **ALWAYS use an insulin syringe to draw up actrapid.**
- Fixed rate of 0.05 unit/kg/hr (max initial rate 15units/hr).
- IV fluids as per policy (also on reverse of chart)
- When glucose falls below 14, give 10% glucose (continue saline, guide by Na and osmolarity).
- Consider potassium replacement (see chart).
- If CBG falls quickly (>4.0 - 6.0 mmol/l/hr, reassess).
- Avoidance of hypos (aim CBG 10-15 in 24 hours). Adjust insulin infusion by 1 unit/hr to achieve desired blood glucose.
- When HHS resolved, if not eating and drinking, switch to VRII.
- When HHS resolved, if eating and drinking, give food and usual diabetes medications and stop FRII.

Variable Rate Insulin Infusion (VRII):

- Must be prescribed on Sunrise.
- 50 units Actrapid (0.5ml) in 50ml normal saline.
- **ALWAYS use an insulin syringe to draw up actrapid.**
- Use original chart (not a photocopy) - Order No – DW9497.
- Dose is based on the relevant scale. Start with scale A unless patient is usually on a total daily dose of >80 units insulin.
- IV fluids as per policy (also on reverse of chart)
- When glucose falls below 14, commence 0.18%/4% dextrose.
- Consider potassium replacement (see chart).
- Consider BP.
- Slower fluids in young people, elderly, pregnant, heart or renal failure (any concerns, modify the rate as necessary).
- If Capillary Blood Glucose (CBG) in green, consider whether the VRII needs to continue.
- If 3 x CBGs in Amber, call doctor to consider changing scale.
- If CBG <4.0 mmol/l (Red), stop VRII, treat as per hypoglycaemia guidelines. When treated, restart VRII, Doctor to consider changing scale.
- If CBG >14 mmol/l (purple), call doctor to consider changing scale.
- Consider Potassium replacement (see chart).
- If decision has been made to stop VRII, give usual S/C fast acting insulin or usual oral diabetes medications with meal and stop VRII 30 mins later.
- When FRII/VRII stopped, continue hourly monitoring for minimum 2 hours then return to usual monitoring regime. Check ketones if CBG>15 (or any concerns).

The aim of treatment is to; treat the underlying cause and gradually and safely, normalise the osmolarity (aiming for 3-8mmol/kg/hr), replace fluid and electrolyte loss, normalise blood glucose levels, prevent other potential complications such as cerebral oedema and prevent foot ulceration.

Considerations/cautions:

- Consider more rapid replacement if SBP below 90 mmHg.
- Caution in the elderly, where too rapid rehydration may precipitate heart failure, but insufficient replacement may fail to reverse acute kidney injury.
- Consider mixed DKA/HHS.
- Does history suggest sepsis/vascular event or recent change in medication.
- Assess degree of dehydration.
- Mental state assessment
- Assess foot risk score (assume high risk if state of consciousness altered).
- Blood cultures/ECG/CXR/full blood count/urinalysis.
- If not improving, seek senior advice.
- Newly diagnosed diabetes? or change in medication regime? HHS patients should mostly go home on insulin at least until review. Ensure diabetes follow up appointment has been arranged?

Hypoglycaemia:

- **A serious complication of diabetes that is life threatening.**
- The most acute diabetic emergency, requiring immediate treatment.
- Happens when the level of glucose in the blood has dropped too low – A Capillary Blood Glucose (CBG) less than 4.0mmol/L.

Can happen when:

- Patients are on insulin and/or oral hypoglycaemic drugs (not metformin).
- They have a reduced carbohydrate intake (including delayed meals).
- Vomiting, reduced appetite, starvation.
- Inappropriately timed insulin or oral medications.
- Renal impairment/Acute Kidney Injury/Severe Hepatic Dysfunction.
- Strict glycaemic control.
- Previous history of hypoglycaemia.
- Exertion (e.g., Mobilisation after period of inactivity, increase in activity etc).
- Changes in diabetes medication (also consider if steroids have recently been reduced).

Symptoms:

- Sweating/clammy/shaking/trembling/pallor.
- Palpitations.
- Hunger.
- Lips and tongue tingling.
- Odd behaviour.
- Confusion/drowsiness.
- Seizures.
- Loss of consciousness.
- Headache.
- Nausea.
- Not all patients will have hypo awareness or show symptoms. Know which of your patients are diabetic and if you are ever concerned, check CBGs more frequently.

Treatment:

- Hypo boxes are situated in all clinical areas.
- Check CBG to confirm hypo.
- If on Variable Rate Insulin Infusion, stop this, then restart when treatment successful.
- Assess conscious level (AVPU) + ABCDE assessment.
- Can the patient swallow (if not, will need to utilise IV route).
- Give 15-20g quick acting carbohydrate.

- Repeat CBG 10-15 mins later.
- If CBG still <4mmol/L, repeat 15-20g quick acting carbohydrate (up to 3 times in total).
- If after 3rd time, contact a doctor to consider Glucagon 1mg IM/ Oglugo 1mg SC or IV 10% glucose (150-200ml over 15 minutes).
- Once CBG is >4.0mmol/L, and patient has recovered give a long-acting carbohydrate.
- Consider Diabetes Outreach Team (DOT) review.
- Complete hypo record book.
- Increase CBG monitoring accordingly.

Considerations:

- Patients on low potassium diet should avoid orange juice.
- If using sugar in water, renal patients on fluid restriction should only use 50mls.
- Sugar in water is not suitable with patients on acarbose as it prevents the breakdown of sucrose to glucose.
- Glucagon may be less effective (alcohol, starvation, liver disease).
- Patients given glucagon will need double portion of long-acting carbohydrate.
- DO NOT OMIT INSULIN (does may need review).
- Do medications require review.

Hyperglycaemia:

Hyperglycaemia is when capillary blood glucose levels are >14mmol/L.

This could be due to; poor/non-compliance with treatment, steroid treatment, infection, missed medication/insulin doses, poor diet, lipohypertrophy etc.

In hospital when CBG's are >14mmol/L - capillary blood ketones should be checked.

The medical team looking after the patient could consider titrating medication/insulin doses. They could also consider utilising Actrapid (4 units if CBGs >15mmol/L, 6 units if CBGs >20mmol/L).

If further support is required for persistent hyperglycaemia, then a referral to DOT can be made via Sunrise.

Insulin:

The **5 types of insulin** are:

- *rapid-acting insulin*
- *short-acting insulin*
- *intermediate-acting insulin*
- *mixed insulin*
- *long-acting insulin*

Rapid-acting insulin

Rapid-acting insulin starts working somewhere between 2.5 to 20 minutes after injection. Its action is at its greatest between 1 and 3 hours after injection and can last up to 5 hours. This type of insulin acts more quickly after a meal, similar to the body's natural insulin, reducing the risk of a low blood glucose (blood glucose below 4 mmol/L).

Rapid acting insulin must be given either 10-15 minutes before or directly with food.

Some examples of **rapid-acting insulin** are:

- *Fiasp and NovoRapid® (insulin aspart)*
- *Humalog® (insulin lispro)*
- *Apidra® (insulin glulisine).*
- *Trurapi (Insulin aspart)*

(Fiasp – rapid acting insulin with faster onset of action. It is designed to improve blood glucose levels after a meal.)

Short-acting insulin

Short-acting insulin takes longer to start working than the rapid-acting insulins.

Short-acting insulin begins to lower blood glucose levels within 30 minutes, so you need to have your injection 30 minutes before eating. It has its maximum effect 2 to 5 hours after injection and lasts for 6 to 8 hours.

Short acting insulin must be given either 10-15 minutes before or directly with food.

With the exception of Actrapid when being utilised for the treatment of hyperglycaemia.

Short-acting insulins currently available are:

- *Actrapid®*
- *Humulin® R*
- *Insuman*

Intermediate-acting insulin

Intermediate-acting and long-acting insulins are often termed background or basal insulins.

The intermediate-acting insulins are cloudy in nature and need to be mixed well.

These insulins begin to work about 60 to 90 minutes after injection, peak between 4 to 12 hours and last for between 16 to 24 hours.

Intermediate-acting insulins currently available are:

- *Humulin® NPH (a human isophane insulin)*
- *Insulatard a human isophane insulin*
- *Insuma*

Long-acting insulin

Also known as background/basal insulins. Can last between 16-42 hours depending on the type and brand (so it is possible for some patients to be on these twice a day).

The long-acting insulins currently available are:

- Lantus® (glargine insulin) – slow, steady release of insulin with no apparent peak action. One injection can last up to 24 hours. It is usually injected once a day but can be taken twice daily.
- Toujeo (glargine insulin) – this insulin has a strength of 300 units per ml so is 3 times the concentration of other insulin. It is given once a day and lasts for at least 24 hours. Toujeo gives a slower, steadier glucose profile especially during the night.
- Levemir® (detemir insulin) – slow, steady release of insulin with no apparent peak action and can last up to 18 hours. It is usually injected twice daily.
- Tresiba (Degludec Insulin – 100u/ml / 200u/ml) – is an ultralong- acting basal insulin analogue. It is given once a day and lasts for at least 42 hours.

Mixed insulin

Mixed insulin contains a pre-mixed combination of either very rapid-acting or short-acting insulin, together with intermediate-acting insulin.

Mixed insulins must be given 10-15 minute before or directly with food.

The mixed insulins currently available are:

Rapid-acting and intermediate-acting insulin

- NovoMix® 30 (30% rapid, 70% intermediate)
- Humalog® Mix 25 (25% rapid, 75% intermediate)
- Humalog® Mix 50 (50% rapid, 50% intermediate)

Short-acting and intermediate-acting insulin

- Humulin® M3 30/70 (30% short, 70% intermediate).

Insulin syringes:

Syringes are manufactured in 30-unit (0.3 ml), 50-unit (0.5 ml) and 100-unit (1.0 ml) measures. The size of the syringe needed will depend on the insulin dose. For example, it is easier to measure a 10 unit dose in a 30 unit syringe and 55 units in a 100 unit syringe.

Insulin syringes are single-use.

Insulin pens:

Insulin companies have designed insulin pens (disposable or reusable) to be used with their own brand of insulin.

Disposable insulin pens already have the insulin cartridge in the pen. They are discarded when they are empty, when they have been out of the fridge for one month, or when the use-by date is reached.

Reusable insulin pens require insertion of a 3 ml insulin cartridge.

When finished, a new cartridge or pen fill is inserted. Reusable insulin pens are designed by the insulin companies to fit their brand of insulin cartridge/pen fill.

Pen cartridges also need to be discarded one month after commencing if insulin still remains in the cartridge.

Pen needles are disposable needles that screw on to an insulin pen device to allow insulin to be injected. They are available in different lengths, ranging from 4 to 12.7mm. However, research recommends that size 4 to 6 mm pen needles are used. The thickness of the needle (gauge) also varies – the higher the gauge, the finer the needle. It is important that a new needle is used with each injection.

Insulin pumps:

An insulin pump is a small programmable device that holds a reservoir of insulin and is worn outside the body. The insulin pump is programmed to deliver insulin into the subcutaneous tissue of the body (usually the abdomen) through thin plastic tubing known as an infusion set or giving set. Only rapid-acting insulin is used in the pump (Novorapid, Humalog, Fiasp, Apidra).

The infusion set has a fine needle or flexible cannula that is inserted just below the skin. This is changed every 72 hours.

The pump is pre-programmed by the user and their health professional to automatically deliver small continual amounts of insulin to keep blood glucose levels stable between meals. Individuals can instruct the pump to deliver a bolus of insulin each time food is eaten, similar to the way the pancreas does in people without diabetes.

The insulin pump isn't suitable for everyone only Type 1 Diabetes.

Insulin injection sites:

Insulin is injected through the skin into the fatty tissue known as the subcutaneous layer. It shouldn't go into muscle or directly into the blood, as this changes how quickly the insulin is absorbed and works.

Absorption of insulin varies depending on where in the body it is injected. The abdomen absorbs insulin the fastest and is used by most people.

Insulin safety:

Don't use insulin if:

- clear insulin has turned cloudy
- cloudy insulin has lumps or flakes in it, or deposits of insulin are visible on the inside of the vial, pen fill or cartridge and cannot be dissolved by gentle rotation
- expiry date has been reached
- it has been frozen or exposed to high temperatures
- a vial, pen fill or cartridge has been used or has been out of the fridge for longer than one month.

Diabetes medications:

Metformin - stops the liver releasing stored glucose. Helps the body's insulin work better by reducing insulin resistance.

Consider avoiding in: Acute metabolic acidosis (lactate >3mmol/L), Renal impairment (eGFR <30), GI complications or NBM/poor oral intake, if Creatinine >160, raised ALT.

Sulphonylureas (Gliclazide) - stimulates the cells in the pancreas to produce more insulin.

Consider avoiding use or reducing dose in: Renal impairment (eGFR <30), ketoacidosis, risk of hypoglycaemia (ESPECIALLY IN ELDERLY).

Pioglitazone – reduces insulin resistance and improves insulin sensitivity.

Consider avoiding use: history of heart failure and bladder cancer, avoid use in dialysis.

SGLT-2 (Dapagliflozin) - reduces the amount of glucose being absorbed in the kidneys so that it is passed out in the urine.

Consider avoiding use: ketoacidosis, seek advice and guidance in use with patients with lower limb amputation and/or renal impairment, NBM/ poor appetite or acutely unwell. (SGLT-2 can also be initiated for renal and cardiac purposes).

DPP-4i (Linagliptin) - stop the enzyme DPP-4 from destroying incretins. Incretins help the body make more insulin when it's needed and bring down the levels of glucose made by the liver when it's not needed.

Consider avoiding use: ketoacidosis, renal impairment, if already on a GLP-1.

GLP-1 (Semaglutide) - reduce the rate at which the stomach digests food and empties, reduces appetite.

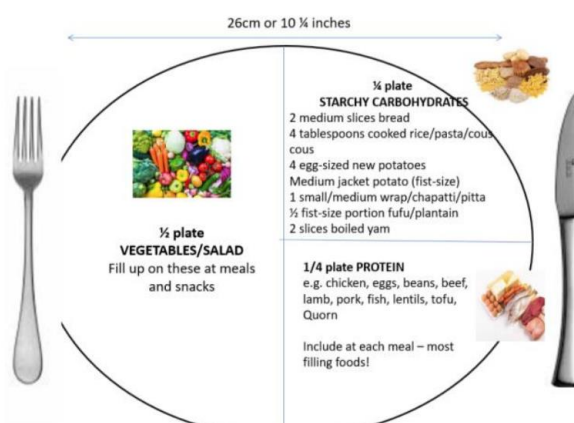
Consider avoiding use or reducing dose in: ketoacidosis, severe gastro-intestinal disease, diabetic gastroparesis, inflammatory bowel disease, renal impairment, avoid when NBM or acutely unwell.

Diet and Lifestyle:

A healthy balanced diet like the rest of the population is recommended for individuals with Type 1 diabetes but the key skill to manage their blood glucose levels is **carbohydrate counting** to match rapid-acting insulin to carbohydrate in a meal. We offer two courses within the Trust for this: the Roche carbohydrate counting course and the well-known DAFNE course. We also recommend snacks between meals to be less than 10g carbohydrates.

Carbohydrate foods directly impact blood glucose levels:

Follow the "T-plate": ¼ starchy carbs, ¼ protein, ½ vegetables or salad:



Resources:

- [Diabetes UK - Know diabetes. Fight diabetes. | Diabetes UK](#)
- [Diabetes - NHS \(www.nhs.uk\)](http://www.nhs.uk)
- [NG28 Visual summary on choosing medicines for type 2 diabetes in adults \(nice.org.uk\)](https://www.nice.org.uk/guidance/ng28)

Policies and Guidelines (available via the HUB):

- Diabetes Ketoacidosis Management in Adults Guideline
- Hyperosmolar Hyperglycaemic State Management Guideline
- Hypoglycaemia in Adults with Diabetes Mellitus Guideline
- Diabetes in Pregnancy Guideline
- Diabetes Management: Adults Undergoing Elective Surgery Guideline
- Diabetes Palliative Care Guideline