

# **Chapter B**

# **Practical Skills**





# **B: Practical Skills**

## **B1: Glucose meters**

Blood glucose meters help you to keep an accurate idea of your blood glucose levels; they are a key part of your diabetes management. Your diabetes team will discuss the different meters available

Meters must be compatible with to be uploaded at clinic, which not all meters are.



#### Meter tips:

- When you come to clinic bring all your meters as we will download them and go through the results with you.
- Explore your meter and look at your average blood glucose readings.
- Make sure the time and date are correct on the meter.
- If you would like to upload your meter from home ask your diabetes nurse for more information.
- If your meter stops working, contact the company who makes it to request a replacement.
- For your meter to keep accurate results it is important to use it properly and keep it clean. You will also been shown how to test your meter with control solution.
- Replace your meter battery when it indicates to do so and take some spare batteries on holiday.





#### Glucose and Ketone test strips:

Glucose and Ketone test strips: These are specific for each meter so it is important your GP prescribes the correct strips. You will need at least 5 glucose strips per day and some spare. Your diabetes nurse will inform the GP of the type of strips you will require.



# **B2: Blood Glucose checking**

#### Procedure for checking / supervising blood glucose check

**Equipment needed:** Blood glucose meter, test strips, finger-pricking device, lancet, sharps bin and cotton wool or tissue.

- 1. Ensure hands are washed and dry them thoroughly. (If hands are cold, run them under warm water or shake them to warm them up).
- 2. Insert new lancet or advance the fastclix lancet as taught.
- 3. Insert strip into blood glucose meter.
- 4. Prick the side of the finger (it is less painful than the finger tips) and wipe away the first drop of blood with cotton wool or tissue.
- 5. Squeeze a small drop of blood by milking the finger from the base to the tip.
- 6. Hold the strip to the blood and allow the strip to suck up the blood. The meter will beep or the display will start counting down when enough blood is received.
- 7. After a few seconds the blood glucose level should appear on the screen. (If an "error" appears on screen this may be due to insufficient blood sample therefore repeat the test.
- 8. Dispose of lancet and test strip as taught.
- 9. Record blood glucose result.

The above is only a guide; always perform/supervise the test as taught by the children's diabetes nurse specialist.





#### Blood glucose checking tips:

- Make sure your hands are clean before you begin. Use water rather than wet wipes (wet wipes contain glycerine that could alter the result).
- Prick the side of the finger, not the middle, or too close to a nail. Using the side is less painful.
- Use a different finger each time and a different part; this will hurt less.
- If you don't get much blood, hold your hand down towards the ground. This should make more blood flow to the fingers.
- Make sure your hands are warm if they are really cold it's hard to draw blood, and finger-pricking will hurt more.

#### When to check:

- Before all main meals (breakfast, lunch and tea) this allows you to correct your blood glucose by adjusting your dose if you are too high or too low.
- Bedtime to make sure you are not too high or low before bed.
- If you are unwell this is essential. You may need to check every 2 hours and give extra insulin if blood glucose is high to avoid ketones and DKA.
- In relation to episodes potentially associated with hypoglycaemia, increased exercise or alcohol ingestion.
- If suspected hypoglycaemia, check to confirm. If unable to get to meter quickly treat first, then check.
- If your blood glucose has been high (greater than 8mmol/l) in the day time and you have given a correction dose, recheck within 2-4 hours to see that your glucose level has returned to target range.

# **B3: Insulin Pens**

These hold 3 mls of insulin (usually 300 units) either in cartridges or as disposable pens. Your diabetes team will advise on the most appropriate pen, as it depends on the type of insulin and whether you need 0.5 unit doses or larger doses.



Make sure you have a spare pen (via GP prescription) and choose different colours for the rapid and long acting insulin so you do not get muddled.





#### Needles

These are attached to the pen and are very fine so that it reduces any discomfort to a minimum. They should only be used once. For children and teenagers the 4 mm needle is recommended. It is important to be careful with needles and dispose of them safely in the special sharps bin.

#### Needle bins

These can be obtained from your GP but usually have to be collected by the council when full.



# **B4: Injection techniques, site care and insulin delivery**

A Diabetes Nurse or a member of the ward team will be there with you at first injection until you feel you can help manage this without their help. By using the guidelines every time, it will soon become part of your daily routine.

Please talk to one of the CYP diabetes nurses if you would like further ideas around supporting injection times. Talking through and involving children in a way that is appropriate for their age, distraction techniques and using soft toys for role play are some of the strategies which can help.

#### Insulin

- Check that the insulin you are to use has not passed its expiry date. Once insulin is in use, it lasts for four weeks and may be stored at room temperature. Unopened insulin must be stored in the fridge.
- Ensure that you give the injection in accordance with the insulin type and the manufacturer's instructions. Rapid acting insulin (eg. Novorapid, Humalog) is to be given as a bolus and is usually injected 15-30 minutes before food. Long acting or basal insulin (eg. Levemir, Tresiba) is given at a set time of the day and is not related to food. Your Diabetes Nurse will advise you on what you should do.





#### Injection technique and rotation

- Observing the nurse perform the first injection will enable you to see the correct technique, sites and also how to support your child during the procedure.
- It is important to move around the injection area and to change sites as fatty lumps (lipos) can develop if you keep using the same area. These lumps can affect the absorption of the insulin and lead to swinging blood glucose levels.
- If you are unsure ask the diabetes team to help and advise you.
- Remember to regularly check injection sites for lipos as: "Lipos can cause Hypos".



#### **Injection Sites**

The preferred site is the top of the buttocks. This area has the most subcutaneous (fatty) tissue which means insulin is less likely to be injected into the muscle. Injecting into the muscle can be more painful and insulin absorbed quickly and unpredictably.

If your child is about to do some activity or exercise such as running or football, insulin injected into the legs will be absorbed very quickly.

#### Site rotation pattern suggestions

There are several rotation methods (see below) that help to prevent excessive use of one injection site and ensure the ideal absorption of insulin and will reduce the risk of lipos.

Rotation between sites and within sites











Children under the age of seven will usually need someone to do the injection for them. If your child needs an injection to be administered for them by a member of staff (school or hospital) or a carer, then a safety needle (BD Autoshield 5mm) is required to prevent needlestick injuries.

**Before Injection** 



After Injection

At all other times use of the shortest needle possible is recommended and these currently are 4mm in length.

Talk to the diabetes nurse about coping and distraction techniques which may help. If you have already tried these strategies an appointment with the diabetes team psychologist may help.

- Remove the pen cap
- Attach a new pen needle
- Prime the needle with 2 units of insulin, holding the pen with needle upright
- Once a drop of insulin has been seen, the pen is ready to use. If a drop of insulin has not been seen repeat the procedure
- Dial the number of units calculated for a meal, snack or correction.
- Choose the injection site and lift a wide skin fold. This helps to hold the skin steady and avoids injecting into the muscle. A lifted skin fold is recommended for all ages but especially 2-6year olds.







• Inject the pen device needle at 90° and press the button/plunger as far as it will go. The dial will reset back to zero to indicate that the dose has been administered.



- Count to 10 before removing the pen device to reduce insulin leakage
- Following the injection, remove the pen needle from the pen using the outer cover (do not try to replace the inner needle cover) and discard carefully in the sharps container
- Replace the pen cap on the pen device
- Always remove the needle after every injection to minimise the risk of accidental injection and prevent reuse of a blunted needle which will be more painful and cause more trauma to the skin.
- Remember that fast acting bolus insulin should be injected into a different site to long acting basal insulin.

Your Diabetes Nurse will help you with this and will be able to advise you in the first few days following diagnosis.

#### Safety devices

Recent European legislation requires that if a safety needle is available, those caring for a person requiring an injection should use this device to protect themselves from a needlestick injury and exposure to blood borne infections.

**Before Injection** 



The diabetes team recommend ward staff demonstrate to children and families injection technique with a 4mm needle (on a soft toy or similar). Actual administration by the nurse will then be done using the safety device (see picture above). School staff and carers will also be encouraged to use this device. Once your child is able to inject themselves the 4mm pen needle will be used.





# **B5: Guide to insulin regimes**

The two most common types of insulin regimes used are **Multiple Daily Injections (MDI)** and **Insulin Pump therapy (IPT)**, also known as continuous subcutaneous insulin infusion or CSII. Both of these involve a basal and bolus insulin being delivered and so are sometimes referred to as "Basal bolus regimes".

#### Multiple Daily Injections (MDI)

MDI involves two different types of insulin - a rapid acting insulin given as a **bolus** with each meal or snack and a long acting **basal** insulin given once or twice a day.



#### Long acting insulin (Basal)

Long acting insulins such as Levemir and Tresiba are given once or twice daily to provide a low level of background insulin (Basal). This long acting insulin provides a steady release to keep the blood glucose level stable throughout the day and night. Long acting insulin has a slower onset time and lasts much longer than the rapid.

Long acting insulin should be given at a similar time each day.

The long acting insulin is required even when not eating or drinking. It is not fast enough to be used for food or corrections.

Insulin Type	Proprietary Name – use when prescribing	Manufacturer	Device	Taken	Onset	Peak	Duration	Typical activity profiles
Long-acting analogue insulins								
Insulin Detemir	Levemir®	Novo Nordisk	Flexpen, cartridge	Once or twice a day	2-4 hrs	6-14 hrs	16-20	
Insulin Glargine	Lantus®	Sanofi-Aventis	Solostar pen, cartridge	,	2-4 hrs	No peak	20-24 hrs	
Insulin Degludec	Tresiba®	Novo Nordisk	Flextouch Pen	Once a day	30-90 mins	No peak	Over 42 hours	





#### Rapid/Fast acting insulin (Bolus)

Rapid acting insulin is given for the food to be eaten and when needed to correct a high blood glucose (BG) level.

Rapid acting insulins such as Novorapid are absorbed more quickly than basal insulin and lasts for 3-5 hours. They are designed to be given before food/drink containing carbohydrate (CHO) to prevent a high blood glucose level or correct back into the target range (4-7mmols/l).

- The insulin to carbohydrate ratio (ICR) is the calculation used to work out how much insulin to give before each mealtime. Your diabetes team will guide you re what insulin to carbohydrate ratios to use. It is not uncommon to use different insulin to carbohydrate ratios at each meal. Rapid acting insulin works best if given 15-30 minutes before food.
- The Insulin Sensitivity Factor (ISF) or Correction dose is the amount of insulin required to bring the BG level back into the target range (4-7mmol/l) e.g. if 1unit lowers the BG level by 5 mmol/l, this will be written as 1:5.

Insulin Type	Proprietary Name – use when prescribing	Manufacturer	Device	Taken	Onset	Peak	Duration	Typical activity profiles
Rapid-acting ana	logue insulins							
Insulin Aspart	NovoRapid <sup>®</sup>	Novo Nordisk	Vial, Flexpen, cartridge					
Insulin Lispro	Humalog®	Lilly	Vial, Kwikpen, cartridge	Just before, with or just after food	10-20 mins	1-3 hrs	2-5 hrs	
Insulin Glulisine	Apidra®	Sanofi-Aventis	Vial, Solostar pen, cartridge for Optipen					

#### Insulin Pump Therapy

An insulin pump is a battery operated device which delivers only fast acting insulin. It is programmed to deliver insulin in small amounts constantly throughout the day to mimic the working pancreas and this is known as the pump basal rate. At mealtimes a bolus of insulin is given by pressing a sequence of buttons to deliver the mealtime bolus after carbohydrate counting and if needed for a correction dose.

- Long acting insulin is not used in insulin pump therapy
- Comprehensive pump training will be provided if you choose to use this method of insulin delivery.



Multiple daily injections and insulin pump therapy offer intensive management and aim to replicate the workings of a normal pancreas whilst also allowing flexibility and tiny, dose adjustments so that diabetes fits your lifestyle.





# **B6: Diabetes Technologies**

Diabetes Technology options are available to support diabetes care. These include Insulin Pump Therapy, continuous glucose monitoring and automated insulin delivery systems.

#### Insulin Pump Therapy

Insulin Pump Therapy (IPT) is another way to deliver insulin under the skin. Insulin is infused in the background over 24 hours (basal insulin) and to match meal carbohydrate or corrections. IPT can provide more flexibility and further options but for some people they can feel like more work. There are a number of insulin pumps including those manufactured by:

- Medtronic
- Insulet
- Tandem
- Ypsomed
- •

Each pump comes with a four year warranty and therefore a four year commitment to the chosen pump. Further discussion with the team helps to ensure individual needs and preferences are considered to ensure the most suitable choice is made.

If you would like to know more about pump therapy, please ask your diabetes nurse or any of the diabetes team. There is an expectation that the family will work closely with the team and a change to this therapy will involve extra nurse-led clinic visits, before and after pump start.

#### **Continuous Glucose Monitors**

Real time Continuous Glucose Monitoring (CGM) can be used with insulin pump therapy or injection therapy and can reduce the variability of glucose levels. This will in turn increase the Time in Range (TiR) when the blood glucose is between 4 and 10mmols/L.

Sensors will show a sensor glucose (SG) reading every 5 minutes and an arrow showing the direction of change. However SG readings lag behind BG readings by approximately 5-10 minutes.







#### Automated insulin delivery (Closed Loop) systems

Automated insulin delivery (Closed loop) systems consist of three parts:

- Insulin Pump
- Continuous Glucose Monitor
- Algorithm that determines insulin delivery



They can improve Time in Range and minimise glucose variability by suspending and also increasing insulin delivery based on the sensor glucose (SG).

Technology is evolving all the time and we are committed to ensuring our children and young people with diabetes have access to the most appropriate technology to help them manage their diabetes. This means an individualised approach.

Our diabetes team is here to support all families to ensure they have all the knowledge and skills required to integrate diabetes care into everyday life.

# **B7: Monitoring and taking care of your diabetes**

Your body works best if your blood glucose levels are not too high and not too low. People who do not have diabetes have blood glucose levels that stay between 3.5 and 7 mmol/L. If you have diabetes, the goal is to keep your blood glucose levels between 4 and 7 mmol/L before meals and on waking, and between 5 and 9 mmol/l approximately 2 hours after meals most of the time. Careful balancing of your insulin doses, diet and exercise will help towards achieving this.

Measuring your blood glucose is the only way of knowing exactly what your levels are. If you go by how you feel, you will only know when you are very low or very high.

#### Daily blood glucose monitoring

This can be done at home, school or when out and about by doing regular finger prick checks, with the equipment we will give you or by using a sensor (see blood glucose checking).

It is recommended that you check at least before each meal, before bed and when you feel low (hypo) or unwell.

Extra checks may be needed at other times such as during illness, following a hypo, stressful periods such as exam time or during a growth spurt.





Patterns and trends of blood glucose levels that are too high or too low are more easily identified with regular monitoring.

If blood glucose levels are significantly high (14mmol/L or more), check for blood ketones.

If blood ketones are above 0.6mmol/L and rising, immediate action must be taken because you are in danger of becoming seriously ill very quickly. (See sick day rules).

#### The importance of measuring and monitoring blood glucose levels

The number displayed on the meter tells you how much glucose is in the bloodstream at the time that the test was carried out. It is measured in units called millimols per litre.

Recommended blood glucose target ranges for children with diabetes are:-

On waking: 4 to 7 mmol/L Before meals at other times of day: 4 to 7 mmol/L After meals: 5 to 9 mmol/L Before driving: At least 5mmol/L

The blood glucose result indicates the action you will need to take to manage your diabetes well on a day to day basis.

Insulin doses are adjusted according to patterns and trends of the blood glucose levels to achieve better control.

If the blood glucose level is high e.g. 8mmols/L or more before a meal then additional insulin is recommended. This is called a **CORRECTION DOSE**.

This extra insulin is added to the food bolus insulin which has been calculated from carbohydrate counting. Within 2-4 hours or by the next meal the blood glucose level should then return into the target range. You will be informed of your correction dose ratio by the diabetes team. The correction dose ratio will change over time as you grow.

Before changing insulin doses you need to consider other things, such as injection sites, rotation, exercise and food (see insulin adjustments and problem solving).





# **B8: Average blood glucose levels and meter uploads.**

#### At home

The HbA1c level effectively represents average glucose levels over a period of 6-12 weeks. A way of monitoring how you are doing between clinic visits is by looking at your average blood glucose levels over 1-2 weeks and you can do this on your glucose meter. The relationship between an average glucose level and HbA1c is shown in this chart below.

HbA1c(mmol/mol)	Average glucose(mmol/L)
20-42	3.8-7
<50	<8.1
50-60	8.1-9.5
61-70	9.6-11.1
71-80	11.2-12.5
81-100	12.6-15.4
>100	>15.4

In order to meet the national target for an HbA1c of 48mmol/mol or less, we would suggest that you aim for a weekly average blood glucose level of 8mmol/L or less (It is important to note that the average blood glucose level is useful only if at least 4 blood glucose checks are done per day).

If your blood glucose average is regularly above 8mmol/L or if you are having hypos more than 10% of the time please contact the clinic so that we can help to see if any changes need to be made to insulin doses or timing.

#### In Clinic

When you attend your diabetes outpatient clinic you should expect that your meter(s) will be uploaded and then the results discussed with you at your consultation. The same will apply to your pumps if you are on a pump. It is therefore essential that all your meters are brought to clinic and that the time and date is correct on the meter. If you wish to obtain a new meter, then please check with the team that it will upload.

### Most clinics targets now:

Average BG (over 14 days)	8mmol
Standard deviation (variability)	3
Time in range (4-10mmol)	70%

# **B9: Uploading and sharing data**

The data collected on the technology you have been provided with is to aid the management of your diabetes. This can be loaded and viewed by yourself and your diabetes team. This allows a visual representation of your blood glucose levels and other information from your meter or sensor over a set time e.g. 2 weeks. Changes to your diabetes management can be made from this data to optimise your diabetes control.





Glooko allows easy uploading of information from most, but not all, glucose meters, insulin pumps, CGM and mobile apps. For technology that does not upload to Glooko other companies have different platforms to upload their devices. Please discuss your technology with your nurse for further information.

# B10: HbA1c or Glycated Haemoglobin

HbA1c or glycated haemoglobin is an indication as to what your blood glucose levels have been over the last 6-12 weeks.

#### What does it measure?

Haemoglobin is present in red blood cells (the Hb of HbA1c) - this is what makes your blood red. Glucose sticks to red cells and the more glucose there is around in the blood, then the more red cells have glucose attached. The average lifespan of a red cell is 120 days and therefore if we measure how many red blood cells have glucose attached to them, it gives us a guide as to the glucose levels in your blood over the last 120 days (3 months).

#### What it does not measure?

It is not a measure of blood glucose as you would get if you are doing a finger prick and testing your blood with a meter. It does not measure sudden changes in your blood glucose and it will not reflect a single day or week.

#### What are normal levels and how does it relate to your blood glucose?

Small blood vessels run throughout the body and get damaged by persistently high blood glucose levels which lead to long-term complications of diabetes such as kidney and eye problems. An HbA1c target level of 48 mmol/mol (6.5%) or lower is ideal to minimise the risk of long-term complications. It can be difficult to achieve, but is worth it. It is important to note if HbA1c levels are above the ideal target of 48mmol/mol or less, that any reduction in HbA1c level reduces the risk of long-term complications.

We will support children and young people with type 1 diabetes and family members to safely achieve and maintain their individual agreed HbA1c target level.

#### How often is it measured?

We aim to measure HbA1c at every clinic visit, at least every 3 months. If it is above 69 mmol/mol (8.5%), we will arrange more frequent appointments to provide you with additional support. After diagnosis of Type 1 diabetes, the first 2 years are really important. Research has shown that achieving target glucose levels and an HbA1c less than 48mmol/mol within the first 12-24 months is protective of future health. We will help you to reach this glucose target within 3-6 months of diagnosis and maintain for as long as possible, by proactive management, using technology and providing practical and emotional support to your family. The First Year of Care Pathway is to help achieve a good start with diabetes.