



## Insulin Pump Therapy

### Hypoglycaemia - Low Blood Glucose Levels

If the blood glucose level (BGL) falls below 4 mmol/L this is called hypoglycaemia.

One or more of the following may occur and are generally early signs of a hypo:

Signs and Symptoms	
<ul style="list-style-type: none"><li>• Hunger</li></ul>	<ul style="list-style-type: none"><li>• Dizziness</li></ul>
<ul style="list-style-type: none"><li>• Pale skin</li></ul>	<ul style="list-style-type: none"><li>• Feeling tired</li></ul>
<ul style="list-style-type: none"><li>• Shaking</li></ul>	<ul style="list-style-type: none"><li>• Headache</li></ul>
<ul style="list-style-type: none"><li>• Sweating</li></ul>	<ul style="list-style-type: none"><li>• Mood changes</li></ul>
<ul style="list-style-type: none"><li>• Drowsiness</li></ul>	

*Glucose is the fastest and safest option. If you plan to treat hypos with other foods please discuss this with your PMH diabetes team to see if they are appropriate*

*The child/adolescent should rest until their symptoms improve. Recheck BGL in 15 – 30 minutes, if the BGL is still below 4mmol/L or the child/ adolescent remains symptomatic, repeat the following treatment.*



## Management of Mild & Moderate Hypoglycaemia

The child/ adolescent should rest until their symptoms improve and BGL above 4mmol/L.

If the BGL is <u>between</u> 2 – 4mmol/L	If the BGL is <u>below</u> 2mmol/L (or the child becomes confused, irritable or drowsy)
<p>1. Immediately give 5 – 15g of fast acting carbohydrate to treat the hypo e.g.</p> <ul style="list-style-type: none"> <li>○ 4-10 Glucodin tablets</li> <li>○ 2 - 4 TruePlus glucose tablets</li> <li>○ 1 small glass of lemonade (60 - 180 mls) (<i>not</i> diet)</li> <li>○ 1-3 heaped teaspoons of sugar</li> </ul>	<p>1. Suspend or disconnect the pump</p>
<p>2. Recheck the BGL in 15 – 30 mins.</p>	<p>2. Immediately give 5 – 15g of fast acting carbohydrate to treat the hypo e.g.</p> <ul style="list-style-type: none"> <li>○ 4-10 Glucodin tablets</li> <li>○ 2 - 4 TruePlus glucose tablets</li> <li>○ 1 small glass of lemonade (60 - 180 mls) (<i>not</i> diet)</li> <li>○ 1-3 heaped teaspoons of sugar</li> </ul>
<p>3. If the BGL is still between 2 - 4mmols or the child/adolescent is still symptomatic, repeat step 1.</p>	<p>4. Recheck the BGL in 15 – 30 mins.</p> <p>5. If the BGL is still between below 4mmol/L, repeat step 2.</p> <p>6. Once BGL above 4mmol/L, follow up with a carbohydrate containing snack of approximately 15g of a slow acting carbohydrate. Some examples are (choose one):</p> <ul style="list-style-type: none"> <li>○ 1 piece of fruit (<i>except strawberries and other berries</i>)</li> <li>○ 1 slice of bread</li> <li>○ 1 glass of milk or a 250ml UHT tetra pack</li> <li>○ 1 muesli bar that fits “everyday” label reading guidelines</li> <li>○ 3 – 4 large cracker biscuit e.g. multigrain premiums</li> </ul>
	<p>7. Reconnect/resume pump once BGL above 4mmol/L.</p>



## Severe Hypoglycaemia

Occasionally the child will become too drowsy to eat or drink safely or will not be able to swallow. A severe hypo can also cause a seizure (fit). If this occurs, **DO NOT** put anything in their mouth. Place the child in the recovery position and check DRABC:

Danger  
Response  
Airway  
Breathing  
Circulation (pulse)

Suspend or disconnect the insulin pump.

- Once the child / adolescent is safe, an injection of Glucagon can be given. Your child/adolescent should respond in 10-15 minutes (manufacturers guidelines).
- Check the child / adolescent's blood glucose level. If the BGL is very low the meter may read "LO".
- As soon as your child / adolescent is able to swallow give sweet fluids such as lemonade. Allow the child to sip this until the BGL is above 4mmol/l (this may take more than 100mls) then follow with a slow acting carbohydrate snack if the child can tolerate this. Some people experience a headache, nausea and vomiting after a severe hypo. Analgesia can be given for the headache. Continue with sips of lemonade until the child / adolescent is no longer vomiting.
- If vomiting persists, or if BGL is not maintained above 4mmol/L contact the on-call Doctor using the emergency pager number (out of hours) or the diabetes educators (8.30am – 4.30pm, Monday – Friday).
- If your child / adolescent does not respond to glucagon call an Ambulance.



# Hyperglycaemia

## (High blood glucose levels)

If the blood glucose level (BGL) is above 15mmol/L this is called hyperglycaemia.

### Signs of Hyperglycaemia

- Increased passing of urine
- Increased thirst
- Tiredness and lethargy

### Possible causes

#### 1. Lack of insulin:

*Bolus:* - incorrect insulin to carbohydrate ratio  
- missed or forgotten dose  
*Basal:* rate too low

#### 2. Flow of insulin interrupted:

blockage or kink in the infusion set  
cannula bent or dislodged  
set not connected properly  
air bubble in the infusion set  
pump is disconnected/ suspended for too long

#### 3. Site not absorbing i.e. due for a line change

#### 4. Site infection

#### 5. Illness

#### 6. Stress

#### 7. Decreased activity

### Problem Solving

- Check the accuracy of the last BGL e.g. hands washed and dried, meter calibrated
- Review the bolus history to ensure that insulin was given with the last meal or snack

- Assess the line for leakages, kinks and air bubbles
- Check the reservoir for air
- Ensure the pump is connected and not suspended (stopped)
- Check that the pump is programmed correctly

## Management of Hyperglycaemia (BGL above 15mmol/L)

<b><i>If Ketones Are Negative</i></b>	<b><i>If Ketones are Positive</i></b>
<ul style="list-style-type: none"> <li>• A correction bolus is required</li> </ul>	<ul style="list-style-type: none"> <li>• More insulin is required</li> </ul>
<ul style="list-style-type: none"> <li>• Re-check BGL in <u>2 hours</u> (to ensure BGL has decreased)</li> </ul>	<ul style="list-style-type: none"> <li>• Using a <b>pen or syringe</b> give an extra <u>50% to 100%</u> of correction bolus (depending on level of ketones) and <b>re-site</b> the cannula</li> </ul>
<ul style="list-style-type: none"> <li>• Another correction bolus may be given <u>after 2 hours</u> if BGL has decreased but remains above your target BGL</li> </ul>	<ul style="list-style-type: none"> <li>• Consider the use of an increased temporary basal rate once the cannula is re-sited</li> </ul>
<ul style="list-style-type: none"> <li>• If BGL increases, give a correction bolus via pen or syringe and re-site the cannula</li> </ul>	<ul style="list-style-type: none"> <li>• Check BGL and ketones every 2 hours</li> </ul>

*Remember that blood glucose levels will rise if carbohydrate has been consumed.*

*Note: Extra correction bolus doses may be required every 2 hours until ketones are negative and BGL has reached target.*

- Contact consultant on call or diabetes clinic if unsure of how much insulin to give.

### **Remember**

**If the insulin flow is interrupted, diabetic ketoacidosis (DKA) can happen very quickly, within 3 – 4 hours as the pump uses short acting analogue insulin only.**



# Sick Day Management FOR PUMPERS

Although a child or adolescent with Type 1 diabetes is not more prone to illness than their peers without diabetes, special care is needed. Illnesses can cause the Blood Glucose Level (BGL) to become unstable and unpredictable. Viral and bacterial infections with fever may cause high blood glucose levels (BGL) whereas severe gastroenteritis may cause low BGLs, especially in younger children. Generally using a pump makes it easier to manage sick days as doses can be changed to match their appetite and BGL.

## General Points:

- **Never stop insulin** as a lack of insulin leads to ketone production
- Test blood glucose levels and ketones (regardless of BGL) every 2 hours.
- Make an appointment with the GP for a medical review to identify the cause of the illness or infection.
- Drink plenty of water – a glass per hour.
- Encourage normal meals and snacks if tolerated and bolus for these.
- If unable to eat, substitute breakfast, lunch and dinner with sweetened fluids and bolus for them (this prevents starvation ketones).
- Continuous vomiting for 2 hours usually requires a hospital admission.
- *Vomiting with ketones is a diabetes emergency, phone immediately.*
- Remember the PMH diabetes team is only a phone call away.

## Signs of Ketones

- Sweet smell of ketones on breath
- Flushed cheeks
- Stomach pains, **nausea and vomiting.**
- Dehydration with dry lips and sunken eyes
- Slow and deep breathing
- Drowsiness, leading to coma



## Sick Day Management FOR PUMPERs

IF BGL ABOVE 15mmol/L	IF BGL BELOW 8mmol/L	IF BGL BELOW 4mmol/L
<p><b><u>Negative ketones</u></b></p> <ul style="list-style-type: none"> <li>• Give a correction bolus</li> <li>• Consider using the temporary basal feature to increase the basal rate by 50 -100% for 2 - 4 hours at a time.</li> </ul>	<p><b><u>Positive ketones trace – low (0.6 – 0.9 on blood test)</u></b></p> <ul style="list-style-type: none"> <li>• Monitor BGL and ketones 2 hourly</li> <li>• Continue basal rate</li> <li>• Bolus for sweetened fluids or food</li> </ul>	<p><b><u>Negative ketones</u></b></p> <ul style="list-style-type: none"> <li>• Treat the hypoglycaemia in the usual way</li> <li>• If hypoglycaemia persists decrease basal and bolus insulin amounts by 25%.</li> </ul>
<p><b><u>Positive ketones</u></b></p> <ul style="list-style-type: none"> <li>• Using a syringe or pen give 50 -100% extra correction bolus and resite the cannula.</li> <li>• An increased temporary basal rate and extra corrections may be required every 2 hours with a new line until the ketones read negative and the blood glucose level has reached your target.</li> </ul>	<p><b><u>Positive ketones moderate - large (1.0 or above on blood test)</u></b></p> <ul style="list-style-type: none"> <li>• Phone for advice</li> </ul>	<p><b><u>Positive ketones</u></b></p> <ul style="list-style-type: none"> <li>• Treat the hypoglycaemia and recheck blood glucose level within half an hour</li> <li>• When the BGL is above 4mmol give sweetened fluids or food and bolus for these</li> <li>• Monitor BGL and ketones 2 hourly</li> </ul> <p>This scenario is complicated to manage and phoning for advice is recommended.</p>



# Ketone Testing

## How to Test the Blood for Ketones\*

1. Wash and dry hands thoroughly
2. Remove electrode from foil sleeve and insert into blood glucose meter (meter will turn on automatically)
3. Apply a drop of blood onto the purple test strip area
4. Apply a drop of blood onto the purple test strip area
5. Record the number in your record book when it appears on the screen
6. For further information please consult the instruction booklet supplied with the meter.

(\* Only valid for blood glucose monitors that can read ketones eg. Optium Exceed and Optium Neo.)

## Interpreting Blood Ketone Results

- A reading of 0.6 or above is considered a positive ketone level
- Readings below 1.0 mmol/L continue with normal blood glucose monitoring and test for ketones if BGL remains over 15
- Refer to Optium Ketone Action Guide for further information, if available
- Readings over 1.0 mmol/L, it is possible that extra quick acting insulin will be required. Please contact the diabetes clinic or on-call doctor for advice, ideally before giving insulin so the adjustment can be made immediately if required

Blood ketone levels (mmol/L)	
• 0 – 0.5	• Negative
• 0.6 – 0.9	• Positive - continue with normal blood glucose monitoring and test for ketones if BGL remains over 15
• 1.0 -1.4	• Phone for advice (before giving insulin if possible as additional insulin likely to be required)
• 1.5 +	• Phone for advice (before giving insulin if possible as additional insulin likely to be required). Emergency hospital presentation may be necessary.



## How To Test the Urine for Ketones\*

1. Ensure ketones test strips are in-date
2. Dip the test area of the ketone test strip into a fresh sample of urine
3. Tap the strip against the container to remove excess urine
4. Close the lid of the ketone test strip bottle tightly
5. After 60 seconds, compare the test area with the colour chart on the bottle.  
(*Note, timing is very important for an accurate result*)
6. Record the result in your record book.

(\* The above information is for the KetoDiabur 5000 Ketone Sticks. If you have a different brand, please refer to the product information guide inside the box).

### Urine Results:

Urine strip colour	
• Beige	• Negative
• Pale pink	• Small
• Dark pink	• Moderate
• Purple	• Large

Remember to check that the urine test strips are in date.

## Interpreting Urine Ketone Results

- Ketones can be detected in the urine and can also be smelt on the breath as a sweet acetone smell
- Negative to trace ketones is of no consequence
- Small ketones are an early warning sign. Test urine again in four hours
- Moderate to large ketones are a danger sign. Ketoacidosis could develop. Extra quick acting insulin should be given. Contact a diabetes educator (office hours) or emergency paging service (out of hours) for assistance with doses. Test both the BGL and ketones every 2 - 4 hours.



# TRAVELLING WITH INSULIN PUMP THERAPY

## General Information

When travelling with a child/ adolescent on an insulin pump, good preparation is vital. Here are some points to help you manage and enjoy your holiday.

- Before you leave, once you have your travel itinerary, discuss insulin adjustment with a diabetes educator either at your clinic visit or via a phone call
- Ensure you have enough diabetes supplies, and always take extra, at least double your normal usage. Include extra dressings, insulin, giving sets, syringes, reservoirs, ketone test strips, batteries, insulin pens and glucagon
- Keep insulin in a cool place until you are able to store it in a refrigerator. If insulin has been left out of the fridge it must be *discarded after one month*
- Always carry extra hypo food, even if meals are supplied
- Ensure you have written down your basal rates, and write down the help line number for your pump company
- Take a copy of "Sick day management for pumpers", and familiarise yourself with medical facilities at your holiday destination
- If travelling within Australia, have the emergency on call phone number for the diabetes consultant
- When travelling across time zones, change your pump clock to local time and date on arrival. Remember to change the time back on your return
- When travelling, it may be an option to use a flat basal rate, either through the temporary basal or patterns feature of your pump. Regular BGLs will assist you in determining insulin requirements. Correction doses can be given to achieve your BGL target. Revert to your usual basal rates on arrival
- Holidays may be very active, consider using the temporary basal feature to decrease the basal rate by 25 -30% to prevent hypos. We recommend that BGL are checked at least 4 times each day and once overnight
- Ensure your child / adolescent is wearing diabetes identification.



## Air Travel

### Prior to departure

- It is essential that you organise travel letters from the diabetes department. These include a letter of introduction to medical services as well as a Customs letter explaining the reason for the supplies and equipment you are carrying onto the plane
- It is recommended that you carry your spare diabetes supplies eg. Insulin, syringe or pen, and hypo food, in your hand luggage. Remember if you are travelling overseas, it is now law that all hand luggage must be in a clear plastic bag, and you are only allowed 100ml of fluid. Check with the local customs office or airline regarding current restrictions
- Keep insulin and prescribed medications in their original boxes with prescription labels. Carry your other diabetes supplies in their original containers
- Be aware of ordering a “special” diet as often the diabetes diet is catering for people with Type 2 diabetes and may not contain enough carbohydrate.

### In flight

- Regular blood glucose checks will assist in managing your levels
- Corrections should only be given every 3 hours. If the BGLs are consistently high, then consider increasing the basal rate by using the temporary basal
- DO NOT put the insulin in the fridge, keep it with you at all times.

### Remember

Insulin preparations and diabetes equipment may vary between different counties, so ensure you have adequate supplies.



## **Medications and Immunization**

- Children and adolescents can have any medications as prescribed by their doctor
- All the usual immunizations can be administered. The flu injection can also be given but is not compulsory.

## **Surgical Procedures**

- Remove the pump for X-rays, CAT scans and MRIs (refer to user manual or contact pump company for more advice)
- We recommend that all operations that require an anaesthetic are well planned. The diabetes specialist should be informed in order that the diabetes operation care protocols are provided
- The insulin pump can be used during the operation. Discuss with the treating team.



## SKIN CARE RECOMMENDATIONS

Usually, when you experience problems whilst using the pump, these problems are related to the infusion sites and sets. You should always suspect that something is wrong with the infusion site whenever you have an unexplained high blood glucose level and especially if ketones are present.

It is important that you take care of your infusion sites so that:

- The insulin is absorbed properly
- Infections can be avoided
- You can prevent lumps at the sites

### How to look after your infusion sites:

- When you change your site, wash your hands and make sure the new site is clean by using the chlorhexadine and alcohol swab
- Change the infusion set and site approximately every 3 days
- Change the infusion set and site if your BGL remains over 15 after 2 correction boluses
- Change the infusion set and site **immediately** if you experience redness, swelling, pain or discomfort at the site. If the inflammation is larger than a 5 cent coin or if symptoms persist, contact the diabetes team at PMH as you may need topical/oral antibiotics
- Wait until the inflammation and swelling has cleared before using the site again
- Rotate the sites each time, making sure you re-site at least 5cm away from previous sites and 5cm away from the naval
- Apply moisturiser to all unused sites every day, preferably after shower/bath. Do not moisturise the new site on the day you are changing the line as the dressing will not stick properly
- If you react to the tapes/dressings, check the tape tips booklet for alternative dressings or call the diabetes clinic at PMH

Princess Margaret Hospital recommendations:

**Moisturiser:**

**Ego QV Cream**

Apply daily to all unused sites.

**Skin Cleansers:**

**Ego QV Wash**

Use as a soap/cleanser in the shower/bath.

Pat dry.

**Sapoderm Soap**

Use as an ordinary soap in the bathroom.

