These guidelines are not intended for starting a patient on an insulin pump. They are intended to give staff not part of the diabetic team information regarding pump therapy if they are asked by patients or parents.

**Background**

Continuous subcutaneous insulin infusions (CSII) or insulin pumps are becoming part of the standard management of type 1 diabetes in children. The research suggests that it is possible to achieve a substantial reduction in HbA1c, reduce complications and return hypo awareness. However it is not a quick fix for all patients with diabetes and many patients may not want a pump or may not be suitable.

**Pumps Available**

We predominantly use the Paradigm Veo pump from Medtronic but there are some children on Accu-Chek Combo from Roche. Each works on a similar principle as below but there is a difference in the setup for each pump.

**How it Works**

The pump delivers a continuous background infusion of short acting insulin (NovoRapid® or Humalog®) via a line to a small needle inserted just under the skin, usually on the abdomen. The basal rate can be programmed to change every half hour if needed. Patients are then able to give bolus doses with food and for correction for high glucose levels. The doses for meals are calculated on the amount of carbohydrate eaten in that meal (see later). It is still necessary to check blood glucose levels on a regular basis (at least four times a day).

**Indications for Pump Use**

In theory insulin pumps can be used for any diabetic patient requiring insulin. It is possible and is done in some centres; to start new diabetics on a pump from diagnosis but this takes many additional resources which we currently do not have.

NICE has recently published guidance on when pumps can be used. These tend to be the recommendations that we use and these have agreement with the Primary Care Trust for funding.

- **Children > 12 years with type 1 diabetes**
  - Attempts to achieve target HbA1c levels with multiple daily injections (MDIs) result in the person experiencing disabling hypoglycaemia. For the purpose of this guidance, disabling hypoglycaemia is defined as the repeated and unpredictable occurrence of hypoglycaemia that results in persistent anxiety about recurrence and is associated with a significant adverse effect on quality of life **or**
  - HbA1c levels have remained high (that is, at 8.5% or above) on MDI therapy (including, if appropriate, the use of long-acting insulin analogues) despite a high level of care.

- **Children < 12 years with type 1 diabetes:**
  - MDI therapy is considered to be impractical or inappropriate **and**
  - Children on insulin pumps would be expected to undergo a trial of MDI therapy between the ages of 12 and 18 years.

There are also special circumstances where a pump may be of benefit and the funding for these can be applied for separately.
Before Starting CSII Therapy

Our current practice is that all patients will be on MDI before going on to CSII. They will also need to be carbohydrate counting and adjusting their short acting insulin doses as needed. Regular meetings are held during the year for patients who are interested and may benefit from a pump to look at what is involved and to look at the pumps. Funding is applied for in advance and once it has been approved the pump is ordered.

Carbohydrate Counting

As insulin works on carbohydrates it is possible to adjust the dose on insulin required for a meal based on the amount of carbohydrate in the meal. Carbohydrate counting calculates the amount of “carbs” in a meal and the dose of insulin is based on this using an insulin-to-carbohydrate ratio that is calculated for each patient and each meal. The Paediatric Dietician will teach carbohydrate counting to all patients who are interested in pump therapy. Follow-up sessions will be arranged regularly to support patients through this process. There are various tables with this information available and food packages now give the carbohydrate content of they contain.

Pump Starts

When the pump has arrived a date will be given for the patient to come in. Initially the pumps are loaded with 0.9% saline and the patient continues to give their normal insulin while at the same time programming the pump to give the boluses for meals. After 1 week, insulin is then used and the patients stop giving their subcutaneous injections.

Blood Ketone Meters

All patients on CSII will have a blood ketone meter. As they are not receiving any long acting insulin if there is a problem with the delivery of insulin they can develop DKA quicker than patients on SC insulin. Blood ketone meters give an instant ketone reading whereas it may take some time for ketones to become present in the urine.

<table>
<thead>
<tr>
<th>Ketone Level</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.6 mmol/L</td>
<td>Within the normal range</td>
</tr>
<tr>
<td>0.6 – 1.5 mmol/L</td>
<td>Moderately high ketone levels. May indicate the development of a problem if associated with a high glucose level (&gt; 14 mmol/L)</td>
</tr>
<tr>
<td>&gt; 1.5 mmol/L</td>
<td>If associated with glucose level &gt; 14 mmol/L suggests that there is a risk of developing DKA</td>
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</tbody>
</table>

Common Problems

Training is given to all patients when they start on a pump about how to manage common problems, however they may call out of hours for further clinical advice.

Pump Support

Medtronic supply 24/7 technical support for their pumps and can be contacted on 01923 205 167. Accu-chek can be contacted on 0800 701000 (Monday to Friday 08:00-20:00, Saturday 10:00-16:00, Sunday 10:00-13:00). They do not given any clinical support such as changes in background doses or whether or not to give a bolus dose but will be able to help check if the pump is working correctly or how to do certain functions.

Hyperglycaemia

Common causes:
- Overused/irritated sites
- Incorrect basal rates or inaccurate boluses
- Incorrect priming
- Blood in or leakage from infusion set
- Dislodged or blocked needle
- Empty reservoir
See attached guideline for management.

**Hypoglycaemia**
See attached guideline.

**Other Useful Information**

**Temporary Basal Rates**
It is possible to quickly change the basal rate on the pump by using the temporary basal rate setting. With this you can increase or decrease the basal rate as needed for a set period of time.

If patients are running high glucose levels then they need to *increase* the basal rate. Similarly if they are running low glucose levels then they need to *decrease* the basal rate.

Parents and patients know how to do this, but may need reminding. We would normally suggest a 10% change to begin with but it will depend on the clinical situation.

**Insulin Pens**
Patients of pumps will still need to have supply of NovoRapid or Humalog to use in case there is a problem with the pump that cannot be fixed. Correction and bolus doses can be given this way until the problem with the pump is resolved. They will need to monitor and inject more frequently as there is no background insulin.

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GUIDELINES FOR MANAGEMENT OF HIGH BLOOD SUGAR LEVELS

Is the blood sugar level 14 mmol/l or above?

Yes - Check for ketones
No - No Action

Are ketones present?

Yes

Are you feeling unwell, nauseous, vomiting, drowsy or breathing heavily?

No

1. Give correction bolus using the pump
2. Try to identify the cause of the high blood sugar reading

Yes

Telephone the paediatric diabetes nurse specialist (during office hours) - 01932 723314 or the on-call paediatric registrar (outside office hours) - 01932 872000 OR go to the Paediatric A&E Department.

No

Repeat blood sugar level in one hour

Is the Blood Sugar level less than previous reading?

No

Yes - no further action

- Give a correction bolus using an insulin pen NOT the insulin pump.
- Change the whole infusion set and reservoir.
- Drink plenty of liquids that contain no calories (e.g. water, sugar free juice).
- Try to identify the cause of the high blood sugar levels.
- When ketones or an infection are present, extra insulin is usually required. Discuss this with the diabetes team.
**Guideline for Management of Hypoglycaemia**

This is defined as a blood sugar level under 4mmol/L. Most hypoglycaemic episodes will be mild. **Follow the 15 rule**

- Test the blood sugar level
- Give 15g rapid acting carbohydrate e.g. 120-150 ml juice
- Check the blood sugar level 15 minutes later
  - If over 4mmol/L – no further action

If under 4mmol/L give another 15g rapid acting carbohydrate
- Check the blood sugar level 15 minutes later
  - If over 4mmol/L – no further action

NB A starchy carbohydrate follow up snack is no-longer necessary to maintain the blood sugar level so if the child is hungry after a hypo a normal bolus of insulin will be necessary. The calculation of the insulin will need to be done by Bolus Wizard as this programme will take into account the fact that the blood sugar has been low and it will reduce the insulin dose accordingly.

**Moderate Hypoglycaemia**

The child becomes confused and disorientated and unwilling to take the usual hypoglycaemic treatment.

- Suspend / disconnect the insulin pump for 15-30 minutes
- Administer Glucogel to inside of cheeks, and massage cheeks
- Contact parent
- When orientated, treat as a mild hypo

**Severe Hypoglycaemia**

Loss of consciousness (may have a convulsion):

- Suspend / disconnect the insulin pump
- Dial 999 – tell services you have an unconscious diabetic child on an insulin pump
- Contact parent

Parents may wish to store Glucagen kit in fridge at school for their use or paramedics

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**To Stop Medtronic Insulin Pump**

Press ACT, scroll down using ▼ to SUSPEND then press ACT (it will beep every 15 minutes) and will say SUSPEND on pump, press ACT again

**To Stop Accu-Chek Insulin Pump**

1. In RUN mode, press ⬇️ to move to the STOP YOUR PUMP screen.
2. Press ✅, Your Pump switches to STOP mode and stops delivering insulin.

As long as your pump is in STOP mode, it emits two short beeps – and vibrates once every minute to remind you that no insulin is being delivered.

**To Disconnect the pump**

Gently hold the side grips of the connector with your fingers.
- Twist the connector counter-clockwise
- Remove the connector from the site leaving the canula insitu