Steps required to initiate variable rate intravenous insulin infusion

Prescribers: Steps 1-5 must be completed before VRII can be commenced

Nurses: report insulin preparations and packages in 9’s, so, record insulin infusion rate and CVP concentrations overview

Step 1 Long-acting insulin
No long-acting insulin has been administered to the patient (if applicable).

- Yes (Comprise dose) (20 units per unit of L) (12 units)
- No

- Long-acting insulin needs to be administered concurrently with the VRII

- Yes
- No (before breakfast, lunch, dinner, or end of meal)

- Yes
- No (before breakfast, lunch, dinner, or end of meal)

- Yes
- No

- Yes
- No (before breakfast, lunch, dinner, or end of meal)

- Yes
- No

Step 2 Intravenous insulin prescription (via syringe driver)

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Prescription</th>
<th>Total U/mL</th>
<th>Total Vol/mL</th>
<th>Vol/mL/h</th>
<th>Time Vol/mL/h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 3 Insulin infusion rate scale

<table>
<thead>
<tr>
<th>Insulin dose rate (units/mL)</th>
<th>Scale 1</th>
<th>Scale 2</th>
<th>Scale 3</th>
<th>Scale 4</th>
<th>Scale 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0.2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>0.3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>0.4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>0.5</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Vol/mL/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 h</td>
<td>1.3 mL/h</td>
</tr>
<tr>
<td>24 h</td>
<td>2.6 mL/h</td>
</tr>
</tbody>
</table>

Step 4 Hypoglycaemia management (serum glucose concentration <4 mmol/L)

- As required when serum glucose concentration <4 mmol/L

<table>
<thead>
<tr>
<th>Time</th>
<th>Vol/mL/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 h</td>
<td>1.3 mL/h</td>
</tr>
<tr>
<td>24 h</td>
<td>2.6 mL/h</td>
</tr>
</tbody>
</table>

Step 5 Intravenous fluid to be administered alongside insulin infusion

- Albumin: 0.45% saline solution is recommended. Infusion should be administered at the rate of 100 mL/h.

- Normal saline (0.9%): 85 mL/h

- Lactated Ringer’s (LR): 85 mL/h

- 4% Dextrose: 85 mL/h

- 2.5% Sodium Bicarbonate (2.5% NaHCO₃): 85 mL/h

Step 6 When to use this protocol:

- Yes: Patients with diabetes mellitus who are at risk of hypoglycaemia or for whom hypoglycaemia is specifically indicated.
- No: Patients with diabetes mellitus who do not have type 1 diabetes mellitus or hyperinsulinaemia.

General points

- Aim to keep the serum glucose concentration in the range of 4-10 mmol/L.
- To maintain adequate metabolic control and reduce the risk of hypoglycaemia, particularly in children.

- Intravenous insulin infusion requires a dedicated nurse. Both intravenous insulin and glucose should be delivered by an infusion device that allows for a non-return valve to be used (see Critical Care Checklists).

- Also refer to the diabetes care plan when using this protocol.

Instructions for initiating variable rate intravenous insulin infusion

Step 1 Does this patient usually take, or have they recently taken, a long-acting insulin?

- Yes: If a long-acting insulin has been given in the past 12 h or is due to be given alongside the insulin, it must be recorded and prescribed in the notes.
- No:

Step 2 Prescribe intravenous insulin preparation

- 50 units of soluble insulin (peninsulin) made up to 40 mL with sodium chloride 0.9% to give a 1 unit/mL solution.

Step 3 Select the appropriate insulin infusion rate scale

- The appropriate rate of insulin infusion depends on the patient’s insulin sensitivity and whether they have had a long-acting insulin in the past 12 h.
- Select one from the four scales below (divided as scales A-D) and write this on this step. The scale may be subject to adjustment (see over).

- Patient characteristics

- Long-acting insulin given within the past 12 h: preferred for further details refer to insulin sensitivity scale (see table below).

- Does condition require anti-diabetic agents only?

- Insulin at total daily dosage of 0.1-0.5 U/kg/day in oral anti-diabetic agents

- Insulin at total daily dosage of 0.5-1 U/kg/day in oral anti-diabetic agents

- Insulin at total daily dosage of >1 U/kg/day in oral anti-diabetic agents

- Lactose free, low carbohydrate diet

- Severe illness with diabetes mellitus

Step 4 Prescribe glucose for the management of hypoglycaemic episodes

- Sign prescised for glucose 12 g/h to be administered if necessary for hypoglycaemia, in accordance with hypoglycaemia management protocol.

Step 5 Prescribe intravenous fluids to run alongside insulin infusion

- Step A—The prescriber should check and write down the intravenous solution to be added to the insulin infusion (see the chart below for a list of intravenous solutions used with this insulin infusion). The intravenous fluid should be compatible with the insulin concentration to be infused. The intravenous fluid should be administered at a rate of 100 mL/h. If the serum insulin concentration is outside the target range (4-10 mmol/L), adjust insulin dosage as shown in the Step 4 prescription.

- Step B—Additional fluid is required, it should be prescribed separately and administered via a different cannula.
Instructions for the administration and cessation of intravenous insulin infusion

A Monitoring capillary blood glucose and serum electrolyte concentrations

- Initially monitor CBC every hour while on VRI
- When noise and infusions are stable for 2 hours and patient is conscious and there are no clinical changes, then monitor CBC every 2 hours
- Check serum potassium every 4-6 hours

B Managing hypoglycaemia and hyperglycaemia

<table>
<thead>
<tr>
<th>DBS concentration (mmol/L)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12 mmol/L for 2 consecutive testing and/or dropping to &lt;12 mmol/L per hour</td>
<td>Insulin infusion fluids and canes are absent before stabilizing</td>
</tr>
<tr>
<td>&gt;145 mmol/L for 3 consecutive testing and/or rising by &gt;45 mmol/L per hour</td>
<td>Insulin infusion fluids and canes are present before stabilizing</td>
</tr>
<tr>
<td>&gt;18 mmol/L</td>
<td>Decrease insulin infusion to 3-6 U/h and/or increase sulphonylurea/hypoglycaemic agents (if used)</td>
</tr>
</tbody>
</table>

C Planning for the resumption of subcutaneous insulin administration

- Complete details of the patient's usual diabetes treatment in the rare provision. This may be done by a doctor, diabetes specialist nurse, or pharmacist

D Stopping the intravenous insulin infusion when it is no longer required

- Stop the infusion when the patient is eating and/or taking normally and insulin/water are monitored

- To stop the intravenous insulin infusion at a meal time, and when an appropriate dose of subcutaneous insulin can be given

<table>
<thead>
<tr>
<th>Previous result (mmol/L)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not previously on Hct</td>
<td>Stop VRI at any time</td>
</tr>
<tr>
<td>Previously on Hct</td>
<td>Stop VRI 30 minutes after meal 1 and 30 minutes after meal 3</td>
</tr>
</tbody>
</table>

- If long acting basal insulin continued with VRI

<table>
<thead>
<tr>
<th>Blood glucose (mmol/L)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;18 mmol/L</td>
<td>Stop VRI at any time</td>
</tr>
<tr>
<td>12-18 mmol/L</td>
<td>Insulin basal plus 2-4 U insulin meal 1 and continue long-acting insulin at usual time</td>
</tr>
</tbody>
</table>

Additional guidance on the use of Scale

Instead of withdrawing all subcutaneous insulin, some patients (usually those with type 1 diabetes) may continue to receive long acting basal insulin (e.g., Lente®) or a premixed insulin (e.g., NovoMix®) to maintain the usual insulin profile. This patient is likely to require less insulin/less VRI infusions while on VRI and should be titrated on Scale.

Beware the name & dose of insulin and insulin in the last 12 hours incident up to the time of administration. The prescriber must indicate whether the long acting basal insulin is to be continued or withdrawn on VRI protocol. If basal long acting insulin is to continue, this must be prescribed on part A of the prescription.

If long acting insulin is to be withdrawn after starting VRI, then an appropriate scale must subsequently be prescribed (DBS is the range below 12 mmol/L).