MANAGEMENT OF PEOPLE WITH DIABETES ON THE SURGICAL WARDS

1. GENERAL PRINCIPLES

- The management of people with diabetes on the ward is generally very straightforward, providing simple principles are followed.

- The goal is to maintain blood glucose concentration between 5-10 mmol/l in the peri-operative period.

- Usually, the consultant anaesthetist will give specific instructions as to how they wish a patient’s diabetes to be controlled peri-operatively.

- Advice is also available from the diabetes registrar.

- There is a big difference between people with Type 1 diabetes (who have an absolute deficiency of insulin) and people with Type 2 diabetes (who have a relative insulin deficiency, combined with insulin resistance). The former are at definite risk of ketoacidosis, the latter are not, but patients of both Types can still develop severe hypoglycaemia.

- People with diabetes treated with insulin and/or sulphonylureas (e.g. gliclazide/glipizide) are at potential risk of hypoglycaemia.

- Critical care areas have their own protocols for diabetes management and are not covered by these guidelines.
2. INTRAVENOUS INSULIN

- There are two modes in which IV insulin and glucose may be administered – either the insulin and glucose are administered in the same infusion bag (a GKI regimen) or the insulin and glucose are administered by separate infusion devices (insulin sliding scale regimen).

- The *sliding scale* regimen is less labour intensive and is ideal for patients with marked hyperglycaemia. However, if the glucose infusion is interrupted, the continued infusion of unopposed insulin can result in severe hypoglycaemia and so close monitoring of blood glucose concentrations is required. **This is the favoured regimen for use within the Division.**

- The *GKI regimen* is more labour intensive for the medical and nursing staff and is less suitable for markedly hyperglycaemic patients. In addition, if used for greater than 24 hours, the high volume of glucose constitutes a large hypotonic fluid load. However, if there is an infusion device failure, then both insulin and glucose will stop together, thereby reducing the risk of significant hypoglycaemia.

- In practice, the choice of insulin and glucose regimen will often be dictated by the familiarity of the nursing staff on the wards and the anaesthetist.

- Remember, **intravenous insulin has a half-life of only 2.5 minutes**, so if intravenous insulin is disconnected for any appreciable length of time, hyperglycaemia will quickly ensue (unless subcutaneous insulin has been given).

### Insulin Sliding Scale Regimen

- The insulin infusion is prepared by adding 50 Units of Actrapid insulin to 0.9% saline in a syringe to a total volume of 50ml. Thus, 1 ml of the solution contains 1 unit of insulin. The doses of insulin are adjusted according to a sliding scale, which is prescribed as below.
<table>
<thead>
<tr>
<th>BG (mmol/l)</th>
<th>Insulin infusion (Units actrapid/hour = ml/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;16</td>
<td>6 (test urine for ketones, call Dr the sliding scale may need revision)</td>
</tr>
<tr>
<td>13–15.9</td>
<td>4</td>
</tr>
<tr>
<td>10–12.9</td>
<td>3</td>
</tr>
<tr>
<td>7.0–9.9</td>
<td>2</td>
</tr>
<tr>
<td>5.0–6.9</td>
<td>1</td>
</tr>
<tr>
<td>4.0–4.9</td>
<td>0.5</td>
</tr>
<tr>
<td>&lt;4</td>
<td>off (call Dr, the sliding scale may need revision)</td>
</tr>
</tbody>
</table>

- Capillary blood glucose should be tested every hour. It is crucial that medical staff monitor the pattern of blood glucose every 2-4 hours as the sliding scale may require modification to ensure that blood glucose concentrations remain between 5 and 10 mmol/l.

- Commence glucose infusion with 20 mmol/l of KCl – infusion should run at 50 ml/hr. Usually this will be 5% or 10% glucose, but in some special circumstances (e.g. neurosurgery) an infusion of 5% glucose/0.45% saline is preferred. The anaesthetist will advise which glucose infusion should be used. If the patient is very hyperglycaemic, the glucose infusion should be deferred until the intravenous insulin has lowered the blood glucose to <14 mmol/l.

- The insulin and glucose infusions should both be given through the same IV cannula, rather than separate cannulae, to avoid the danger of a blocked cannula resulting in only one of the two drugs being given.

- The insulin syringe should be attached to a ‘PCA giving set’, incorporating a Y-connector with a one-way valve for attaching the glucose infusion. The one-way valve prevents insulin being pumped backwards into the glucose giving set.

- Inform anaesthetist if blood glucose is less than 4 mmol/l or greater than 16 mmol/l.
• If capillary blood glucose is greater than 20 mmol/l, take blood for urgent laboratory glucose and U&E’s (for bicarbonate level).

• If blood glucose concentrations are stable and in the desired range, the frequency of monitoring may be reduced, e.g. to 2 hrly.

• U&E’s and a laboratory glucose should be checked daily while the patient is on intravenous insulin and glucose.

• Be prepared to vary the KCl content of the intravenous fluids according to plasma K⁺ levels. Be especially careful in patients with renal impairment.

• If patient is on intravenous insulin and glucose for greater than 24hrs, ensure that Hartmann’s solution is also given to avoid hyponatraemia. Remember 10% glucose is hypertonic. This glucose infusion is not designed for volume replacement, but glucose control. Extra fluids such as Hartmann’s will invariably be required and these can be piggy-backed in through a separate IV infusion line. However, if patients are volume overloaded, discuss management with the anaesthetist or diabetes registrar.

**GKI Regimen**

• The standard initial prescription for a GKI regimen is:
  500ml 10% glucose
  20mmol/l KCL
  Insulin (usually 10 units of Actrapid)
  Infuse at rate of 50ml/hr

• The initial starting doses are not, however, precise. If a patient is on very low or high doses of subcutaneous insulin, then the dose will need to be
decreased/increased as appropriate. **If in any doubt, call the anaesthetist or diabetes registrar.**

- Monitor capillary blood glucose hourly. Insulin doses are adjusted as below.

- If blood glucose rises to greater than 12 mmol/l, put up a new GKI with 4 units MORE INSULIN in the bag and recheck capillary blood glucose within 1 hour.

- If blood glucose falls to below 6 mmol/l, put up a new GKI bag with 4 units LESS INSULIN and recheck capillary blood glucose within 1 hour.

- If blood glucose is less than 3 mmol/l at any stage, or the patient has symptomatic hypoglycaemia, discontinue GKI and commence 10% glucose at 100ml/hr until blood glucose greater than 5 mmol/l; GKI may then be recommenced with appropriate adjustment of insulin dose.

- Inform the anaesthetist if blood glucose is less than 4 mmol/l or greater than 16 mmol/l.

- If capillary blood glucose is greater than 20 mmol/l, take blood for urgent laboratory glucose and U&E’s (for bicarbonate level).
3. MANAGEMENT OF PEOPLE WITH INSULIN-TREATED DIABETES

There is usually no need to start IV insulin the night before surgery.

Pre-op Management

- Measure laboratory blood glucose, HbA1c and U and E at the pre-admission clinic and, on admission, if the patient is unwell.

- Liaise with the anaesthetist.

- Encourage a normal oral intake and usual drugs on the day before surgery. Instruct to fast for 6 hours for food and 2 hours for clear fluids (i.e. no milk and no carbonated drinks). Non-carbonated glucose drinks can continue till 2 hours pre-op.

- Some patients take before bed a dose of a very long-acting insulin called INSULIN GLARGINE or LANTUS. Some of this insulin may still be present in the bloodstream the following morning, resulting in an increased risk of hypoglycaemia in the fasting patient. Therefore, monitor blood glucose carefully. The doses of other night-time insulins such as Humulin I, Mixtard or Insulatard can often be left unaltered. If a patient has very strict glycaemic control, they are at increased risk of hypoglycaemia.

- If patient is taking oral hypoglycaemic agents, as well as insulin, the oral agents should be managed according to the principles in section 3.

Minor Surgery

When immediate post-operative resumption of oral intake is likely, the following protocol may be used:

- The patient should be first on the operation list (preferably am).

- Omit breakfast and the morning dose of insulin (and oral hypoglycaemic agents, if taking these).
• Check blood glucose hourly from 8am.

• No further action is required if the blood glucose remains between 5 -10 mmol/l. Intravenous glucose and/or insulin may be required if blood glucose moves outwith this range.

• Subcutaneous insulin is given with food post-operatively. The anaesthetist or diabetes team will advise about the type of insulin and dose.

*Major Surgery*

The following protocol should be used for major surgery, when immediate resumption of oral intake after surgery is not planned:

• The patient should be first on the operation list (preferably am).

• Omit breakfast and the morning dose of insulin (and oral hypoglycaemic agents if taking these).

• Intravenous insulin should be commenced on the morning of surgery. The precise timing will usually be advised by the anaesthetist, but is usually at 8am or on arrival in theatre. The infusion may need to be started earlier if blood glucose is outwith the 5-10 mmol/l range. If the patient is very hyperglycaemic, the glucose infusion should be deferred until the intravenous insulin has lowered the blood glucose to <14 mmol/l.

• Post-operatively, the patient can commence eating while intravenous insulin and glucose is running. A small dose of subcutaneous insulin may be given with the first meal, but the exact dose and type of subcutaneous insulin to be given should be discussed with the anaesthetist or diabetes registrar.

• Once confident that oral feeding is re-established, give subcutaneous insulin 30 minutes before the next meal, and discontinue the intravenous insulin no earlier
than one hour after the meal. The exact dose and type of subcutaneous insulin to be given should be discussed with the anaesthetist or diabetes team.
4. MANAGEMENT OF PEOPLE WITH NON-INSULIN TREATED DIABETES

In general, patients with well-controlled Type 2 diabetes, managed with diet and/or oral hypoglycaemic agents alone, require only close glycaemic monitoring during the perioperative period. Intravenous insulin is generally only required if there is sustained post-operative fasting or if glycaemic control is very poor, i.e. blood glucose concentrations consistently >12 mmol/l.

- Measure laboratory blood glucose, HbA1c and U and E at the pre-admission clinic and, on admission, if the patient is unwell.

- Liaise with the anaesthetist.

- Encourage a normal oral intake and on the day before surgery. Instruct to fast for 6 hours for food and 2 hours for clear fluids (i.e. no milk and no carbonated drinks). Non-carbonated glucose drinks can continue till 2 hours preop.

- If the patient is on a long-acting sulphonylurea, e.g. glibenclamide, this should be changed to a shorter-acting version, e.g. glipizide or gliclazide, at least five days before surgery. If this has not been changed, the longer-acting OHA’s should be omitted the evening before surgery, to minimise the risk of hypoglycaemia.

- The precise time at which Metformin should be omitted before surgery is controversial. Discuss with the anaesthetist. It should certainly be omitted on the morning of surgery and some clinicians believe it should also be omitted the evening before surgery.

- The patient should be first on the operation list (preferably am).

- Check blood glucose 2 hourly before surgery. If blood glucose greater than 12 mmol/l, commence intravenous insulin and manage in same way as patient with insulin-treated diabetes. Usually, a lower dose of glucose is required.
• Otherwise avoid glucose-containing infusions and check capillary blood glucose 2 hourly.

Post-Operative Management

• OHAs should be recommenced when feeding is re-established. Metformin has been associated with lactic acidosis in the post-operative period. Risk factors include hypoxia, volume depletion, cardiac failure and renal impairment. It is, therefore, very important that metformin is not re-started if there is evidence of any of these precipitating factors and, in particular, serum creatinine should be <150μmol/l. Any concerns regarding the re-introduction of OHAs should be discussed with the anaesthetist or diabetes registrar.

• Patients who have elevated blood glucose concentrations post-op, despite optimal OHA therapy may require subcutaneous insulin; this can be arranged by the diabetes registrar.
5. FINAL COMMENTS

- Diabetes is a serious condition – if you find that someone has high blood glucose levels, and is not already known to have diabetes, do not ignore it. Contact the diabetes registrar for advice.

- People who have been on insulin for a long time sometimes get annoyed when medical and nursing staff try and impose alterations to their insulin therapy. Please discuss any changes with the patient and call the diabetes registrar for advice. Promote self-monitoring of blood glucose and self-administration of sc insulin whenever possible.

- However, do not ignore persistent hyperglycaemia and/or episodes of hypoglycaemia – be pro-active in adjusting insulin and OHA therapy, but always contact the diabetes registrar or anaesthetist for advice.

- Isolated hyperglycaemia generally does not require any treatment – do not be tempted to give extra doses of insulin, unless you have discussed first with the anaesthetist or diabetes registrar.

- Always liaise closely with the anaesthetist

Protocol prepared by Mark Strachan and Susan Nimmo, November, 2002
Updated by Mark Strachan and Janet Jenkins June, 2005