

Guidelines for Management of Diabetes Mellitus during Surgery

Always download latest available version of Guideline from web site, www.diabetes-scotland.org/ggc/html/pages/protocol

Preparation for admission of a person with diabetes scheduled to undergo surgery:

- Consult anaesthetist on whether proposed procedure minor or not.
- Child usually admitted day before procedure, even on afternoon list.
- Ensure all relevant staff know child concerned has diabetes.
- Check ward has a supply of:
 - blood glucose meter testing strips
 - Lucozade.
 - rapid-acting insulin analogue (e.g. Novorapid or Humalog)
 - slow-acting insulin analogue (e.g. Levemir or Lantus).
 - soluble human insulin (e.g. Actrapid or Humulin S)

Available Insulin Types	
• Insulin Aspart	= "Novorapid"
• Insulin Detemir	= "Levemir"
• Insulin Glargine	= "Lantus"
• Insulin Lispro	= "Humalog"
• Soluble Insulin	= "Actrapid" OR "Humulin S"

While Novorapid & Levemir are available from Pharmacy, Humalog or Lantus may substitute for equivalent insulin (e.g. Lantus for Levemir, OR Humalog for Novorapid) if these are routinely used by the patient concerned.

Minor procedures only

- Anaesthetic generally less than 20 minutes duration, but may last up to an hour. Should not have major impact on glycaemic control. Child usually discharged same day as procedure.
- Examples include endoscopy, jejunal biopsy, adenotonsillectomy, grommet insertion, dental extraction, & repeated short procedures (such as for haematology/oncology or burns patients).
- Routine Diabetic Team review not essential, but call department (Tel: 80331/Page: 8054) and/or anaesthetist if any concerns.

Capillary blood glucose (CBG) target range: 4 - 8 mmol/l. May run target range higher (e.g. 6-12 mmol/l) if hypoglycaemic.

- CBG < 4 mmol/l: Hypoglycaemia Requires immediate treatment as follows:
 - *Taking orally:* Immediately: 50 ml Lucozade OR 1 tube Hypostop (Repeat every 10 mins till CBG \geq 4 mmol/l). Long-acting carbohydrate (e.g. digestive biscuit) to prevent CBG fall < 4 mmol/l.
 - *Nil by mouth:* 10 minutes later: Increase infused dextrose (glucose) concentration (e.g. if on NaCl 0.45% Dext 5% change to NaCl 0.45% Dext 10%). May temporarily increase IV fluid rate while making up higher Dextrose concentration fluids, but must resume maintenance rate once higher concentration fluids start or CBG \geq 4 mmol/l.
- CBG > 14 mmol/l: Hyperglycaemia Requires assessment for ketosis status (ketonuria or ketonaemia testing).
 - *Ketonuria:* Neg, trace, small: No further action required except continued monitoring.
 - *Ketonaemia:* Moderate/large: Seek further advice (requires additional insulin - contact Diabetes Team).
 - < 1 mmol/l: No further action required except continued monitoring.
 - \geq 1 mmol/l: Seek further advice (requires additional insulin- contact Diabetes Team).

Pre-op

Morning list

Patient must be first on theatre list

- Normal insulin on DAY BEFORE surgery (e.g. Usual Before Tea & Before Bed doses).
- Fast from solids from 12 midnight, and from fluids from 0400.
- IV fluids (NaCl 0.45% with Dextrose 5%) at maintenance rate, starting at 0800.
- 20% of insulin total daily dose (calculated by adding all insulin doses given in a typical 24-hour period) as slow-acting analogue insulin (Levemir or Lantus) by subcutaneous injection when starting IV fluids.
- Monitor capillary blood sugars HOURLY from time insulin given.

NaCl 0.45% & Dext 10% with KCl

- 7.5 ml NaCl 30% added to
- 500ml Dextrose 10% bag &
- 10 mmol KCl

Afternoon list

Patient must be first on theatre list

- Normal insulin on DAY BEFORE surgery (e.g. Usual Before Tea insulin, & Before Bed insulin if taken).
- 20% of insulin total daily dose (calculated by adding all insulin doses given in a typical 24-hour period) as slow-acting insulin analogue (Levemir) by subcutaneous injection immediately before breakfast.
- 10% of total daily dose as rapid-acting insulin analogue (Novorapid) given *immediately before* breakfast.
- Light breakfast on morning of surgery (approximately 0730-0800), then FAST.
- IV fluids (NaCl 0.45% & Dextrose 5%) at maintenance rate from time insulin given.
- Monitor capillary blood sugars HOURLY from time insulin given.

Insulin Prescribing Tips

- NEVER abbreviate term "UNITS"
- Mixtard 30 is a TYPE, not a DOSE!
- Write out fractional doses fully: e.g. "2.5 (TWO POINT FIVE) UNITS"

Post-op

If eating LUNCH

- Give 20% of insulin total daily dose as rapid-acting insulin analogue (Novorapid) AFTER lunch (to ensure oral intake established before giving insulin).
- Once eating/drinking satisfactorily, IV fluids can be stopped. Monitor blood glucose as required.

If eating TEA

- Resume usual insulin regimen but give AFTER child has eaten in case of refusal/vomiting (continue IV fluids, and call for advice and/or commence GKI infusion as outlined if patient not eating within 2 hrs of usual evening meal time).
- Once eating/drinking satisfactorily, IV fluids can be stopped.
- Monitor capillary blood glucose as often as necessary until stable (e.g. 4 hourly).

If NOT YET eating and drinking:

- Use Glucose/Potassium/Insulin (GKI) infusion (see box at right):
 - Infuse GKI solution at maintenance rate.
 - Use soluble insulin ONLY (e.g. Actrapid or Humulin S).
 - Must use an insulin syringe ONLY to draw up insulin.
- Monitor capillary blood glucose (CBG) hourly until fully alert, *then every 2 hours* until sc insulin restarted.
 - If blood glucose 20 or above: increase soluble insulin concentration in IV Fluids to 16U/500 ml.
 - If blood glucose 6 or less: decrease soluble insulin concentration in IV Fluids to 8U/500 ml.
- If IV fluids required for more than 24 hours, or blood glucose results low/high an insulin sliding scale may be preferred.
 - Discuss with Diabetes Team, anaesthetist, or medical registrar.

GKI Infusion Fluid

- 500ml NaCl 0.45% / Dext10% &
- 10 mmol KCl &
- 10 Units Soluble insulin (Actrapid)

More Complex Surgery and Emergency Procedures

Best managed with: - continuous insulin infusion &] as in the management of diabetic ketoacidosis.
 - separate IV fluids] NB: Use anti-reflux valve if both infusions given via single cannula

- If in good metabolic control and with normal electrolytes, make up an Insulin Solution, 1 unit/ml:
 - Add 50 units of soluble insulin (Actrapid or Humulin S), using an insulin syringe, to
 - 49.5 ml NaCl 0.9% in a 50 ml Luer lock syringe.
- Using a syringe pump, give insulin infusion fluid at the following rates:
 - If blood glucose < 15 mmol/l - 0.05 units/kg/hr.
 - If blood glucose ≥ 15 mmol/l - 0.1 units/kg/hr.
- Make up IV fluids using NaCl 0.45% and 5% dextrose.
 - Add 10 mmol KCl / 500ml IV fluid.
 - Infuse IV fluids at maintenance fluid rate.
- Check capillary blood glucose hourly before, during, and after procedure.
 - Test capillary blood glucose more frequently if clinically concerned (e.g. hypoglycaemic).
- Do not stop insulin infusion completely unless there are problems with persisting hypoglycaemia.
 - The insulin infusion should only be stopped for a short period, until restarting fluids with an increased dextrose concentration (e.g. NaCl 0.45% with 10% dextrose - see box above).

1 unit/ml Insulin Infusion Solution

- Draw up 50 units Soluble Insulin (Actrapid) with an insulin syringe
- Add carefully to 49.5 ml NaCl 0.9% in 50ml Luer Lock syringe

Inform Diabetes Service (T: 80331) &/or anaesthetist if using more complex or emergency surgery protocol

- Nurse Specialist (Page 8054) / Dr. Craigie (Page 8213) / Dr. Gallacher (Page 8253) / Dr. Robertson (Page 8066)

Surgery is a physical stress characterised by catabolism, increased metabolic rate, increased protein and fat breakdown, negative nitrogen balance, starvation and glucose intolerance. The degree of stress will be related to factors such as operation length, type of procedure and the presence of complications such as infection. All of these metabolic effects are exaggerated with diabetes, particularly where there is a virtual absence of endogenous insulin. Marked catabolism results in fatty acid production, ketogenesis, hyperglycaemia and eventually leads to ketosis or ketoacidosis.

Flow chart summarizing peri-operative management of person with diabetes

