

Guidelines for Diabetes Patients on Surgical Wards

Latest version: www.ggc-diabetesscotland.org/for_nhs_staff.html

Preparation of Diabetes Patients admitted for Surgical Procedures

- Consult surgeon or anaesthetist whether planned procedure minor or major.
- Child may be admitted on day of procedure, or the afternoon before to allow for stabilisation.
- Ensure all relevant ward staff know child concerned has diabetes.
- Check ward has a supply of:
 - Blood glucose (BG) meter testing strips.
 - Lucozade, Rapirose, Glucogel, etc.
 - Insulin for SC injection (e.g., Novorapid, Levemir, Tresiba).
 - Insulin for IV infusion (e.g., Actrapid, Humulin S).

Routine Diabetes Management

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 and ketoacidosis.

The aim of routine diabetes care during admission for surgical procedures is therefore to:

- prevent hypoglycaemia
- moderate hyperglycaemia
- prevent ketosis and ketoacidosis
- avoid delay to surgical procedures

Blood glucose management

 BG target 4-8 mmol/l (may aim for 6-12 mmol/l to help prevent low BG).

- **CBG < 4 mmol/l:** **Hypoglycaemia** Requires immediate treatment as follows:
 - Taking orally:* Immediately: 120 ml Lucozade OR 1 tube Glucogel.
 - Repeat: Every 10 mins until Capillary Blood Glucose (CBG) \geq 4 mmol/l.
 - Once CBG \geq 4: Long-acting carbohydrate (e.g., digestive biscuit, bread or toast) to prevent CBG again falling < 4 mmol/l.
 - Nil by mouth:* Immediately: Increase infused dextrose (glucose) concentration e.g., if on Dext 5% (+NaCl) increase to Dext 10% (+NaCl)
 - Temporarily: Increase IVF rate while preparing higher Dextrose conc. fluid. Resume maintenance rate once CBG \geq 4 mmol/l.
- **CBG > 14 mmol/l:** **Hyperglycaemia** Requires *immediate* ketonuria or ketonaemia testing.
 - Ketonuria:* Neg, trace, small: No further action required except continued monitoring
 - Moderate/large: Seek further advice (requires additional insulin).
 - Ketonaemia:* < 1 mmol/l: No further action required except continued monitoring.
 - \geq 1 mmol/l: Seek further advice (requires additional insulin).

Insulins available for administration

The following insulins are available within the UK. Please note that some insulins with similar names actually have very different durations of action and are very different preparations.

- **Fast-Acting:** Apidra *Insulin Glulisine*
FiAsp *Fast Insulin Aspart*
Humalog *Insulin Lispro*
Novorapid *Insulin Aspart*
- **Slow-Acting:** Lantus *Insulin Glargine*
Levemir *Insulin Detemir*
Tresiba *Insulin Degludec*
- **Soluble:** Actrapid *Soluble insulin*
Humulin S *Soluble insulin*
- **Biphasic (Mixed):** Humalog Mix 25 *Insulin Lispro (25%) + Isophane insulin (75%)* NB: This is not Humalog.
Humalog Mix 50 *Insulin Lispro (50%) + Isophane insulin (50%)* NB: This is not Humalog.
Novomix 30 *Insulin Aspart (30%) + Isophane insulin (70%)* NB: This is not Novorapid.

Novorapid and Levemir are both commonly prescribed but may be replaced by Humalog/ Apidra or Lantus/ Tresiba, respectively, if no allergies or sensitivities to new insulins exist. Patients may be allergic or hypersensitive to certain insulins, and this should be discussed with patient and parents before prescribing insulins that differ from those usually taken.

Minor Procedures

Summary

- Anaesthetic usually under 20 mins duration (up to 1 hour), with low impact on glycaemic control.
- Child usually discharged same day as procedure.
- Examples include endoscopy, jejunal biopsy, adeno-tonsillectomy, grommet insertion, dental extraction, & repeated short procedures (such as for haematology/oncology or burns patients).
- Routine Diabetic Team review not essential but call Team and/or anaesthetist if any concerns.
- Calculate **Insulin Total Daily Dose (TDD)** by adding ALL insulin taken in a typical 24-hour period.

Pre-op *See information below if patient using an insulin pump (CSII).*

MORNING LIST *Patient must be first on theatre list. Ensure no allergy to Levemir or other prescribed insulin.*

- Normal insulin on DAY BEFORE surgery (e.g., usual Before Tea or Bed insulin).
- Fast from solids from 12 midnight, and from fluids from 0400 on day of surgery.
- Monitor capillary blood sugars HOURLY from time insulin given.
- IV fluids (NaCl 0.45% with Dextrose 5%) at maintenance rate, starting at 0800.
- 20% of insulin Total Daily Dose (TDD) as slow-acting analogue insulin (Levemir or Lantus) by SC injection when IV fluids start. Prescribe an alternative insulin if patient allergic/ hypersensitive to the one recommended.

AFTERNOON LIST *Patient must be first on theatre list. Ensure no allergy to Levemir or other prescribed insulin.*

- Normal insulin DAY BEFORE surgery (e.g., usual Before Tea or Before Bed insulin).
- Light breakfast on morning of surgery (approximately 0730-0800), then FAST.
- 20% of insulin TDD as slow-acting analogue (Levemir or similar) by SC injection immed. Before Breakfast.
- 10% of insulin TDD as fast-acting analogue (Novorapid or similar) immediately Before Breakfast.
- IV fluids (NaCl 0.45% & Dextrose 5%) at maintenance rate from time insulin given.
- Monitor capillary blood sugars HOURLY from time insulin given.

Post-op *See information below if patient using an insulin pump (CSII).*

IF EATING LUNCH

- Give 10% of insulin TDD as fast-acting insulin analogue (Novorapid or similar) AFTER lunch (ensures oral intake).
- Once eating/drinking satisfactorily stop IV fluids.
- Monitor blood glucose 2-4 hourly.

IF EATING EVENING MEAL

- Resume usual insulin regimen but give dose AFTER child has eaten in case of refusal/vomiting.
- Once eating/drinking well stop IV fluids.
- Monitor capillary blood glucose as necessary until stable (e.g., 4 hourly), but increase frequency if patient clinically unwell or develops hypoglycaemia.
- If patient not eating within 4 hrs of usual evening mealtime call for advice and/or commence insulin VRI infusion (see over).

IF NOT YET EATING AND DRINKING

- Levemir (or similar) should prevent ketosis and maintain blood glucose control for several hours post-op.
- Resume oral intake as soon as patient no longer Nil by Mouth.
- If post-op fasting is prolonged (e.g., beyond 6-8 hours)
 - continue intravenous fluids *and*
 - commence an Insulin Variable Rate Infusion (VRI dose will increase as pre-op Levemir effect wanes).
- If *not* fasted but on a VRI child may resume oral intake on IVF and VRI until adequate intake maintained.

Patient Using Insulin Pump* Undergoing Minor Procedure (www.ggc-youngdiabetes.org):

- If the anaesthetist and surgeon consider it appropriate, a continuous subcutaneous insulin infusion (CSII) pump *may* be used by patients before, during and after a surgical procedure.
- All insulin should then be given via pump, replacing any above recommended Levemir (or similar) SC injection with usual *pump-delivered basal insulin rates*, and any SC Novorapid (or similar) injections with *pump-delivered boluses*, (calculated according to usual pump settings for carbohydrate intake or raised Blood Glucose).
- Continuous (24-hour) parental supervision of insulin pump use is mandatory. If this is not possible, for whatever reason, the pump should be stopped, and all insulin prescribed as SC injections or IV infusion.
- Start and cease IV Fluids as indicated above.

More Complex Surgery (“Major”) and Emergency Procedures

Call CDS (T: 80331 M-F: 0900-1700), Med. Registrar &/or Anaesthetist if using Complex/Emergency Surgery Protocol.

- Best managed with:
 - IV Insulin Variable Rate Infusion (VRI)] commence immediately if an emergency case, or once fasting
 - Appropriate Intravenous Fluids (IVF)] for complex elective procedures (if good glycaemic control) *
- If glycaemic control poor start IVF & VRI at least 12 hrs before procedure, to optimise glucose and treat ketosis.
- Start IVF and Insulin VRI from time of fasting, using current BG value to establish initial insulin infusion rate.
- Add:
 - 50 Units soluble insulin (Actrapid) via insulin syringe to
 - 49.5 ml NaCl 0.9% in 50 ml Luer-lock syringe to give
 - 1 Unit/ml solution.

Suggested initial Variable Rate Infusion of Insulin prescription via IV Syringe Pump*

BLOOD GLUCOSE (mmol/l)	INFUSE SOLUTION AT (ml/hr)	EQUIVALENT TO (Units/kg/hr)
> 22 mmol/l	Weight (kg) x 0.1 ml/hr (= Units/hr)	0.10
14 – 22	Weight x 0.07	0.07
8 – 13.9	Weight x 0.04	0.04
4 – 7.9	Weight x 0.02	0.02
< 4	Weight x 0.01 and INCREASE INFUSED DEXTROSE CONC.	0.01

- N.B.: VRI may need re-prescription in light of clinical response (e.g., if persistent low or high BG’s).
- Use anti-reflux valve if both IV fluid infusion and Insulin VRI given via single cannula.
- Cap BG testing 1-hourly before, during, and after procedure (more often if concerned, e.g., hypoglycaemia).
- **Ketosis will develop following insulin omission.** Do *not* stop insulin infusion unless problems with persisting hypoglycaemia, and then only briefly pending restart with increased Dextrose concentration.
- Discuss with Diabetes Team, Anaesthetist or Medical Registrar if any concerns, esp. if patient ketotic.

Suggested initial Intravenous Fluid Infusion

- NaCl 0.45% and Dextrose 5% (may add 10 mmol KCl / 500ml IV fluid unless contraindicated) OR
- NaCl 0.9% and Dextrose 5% (may add 10 mmol KCl / 500ml IV fluid unless contraindicated).
- Increasing the Dextrose concentration of infused IV Fluids may be required to maintain adequate BG.

HOW TO MAKE UP NaCl 0.45% and DEXTROSE 10% + KCl 10 mmol/500 ml

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

HOW TO MAKE UP NaCl 0.9% and DEXTROSE 10% + KCl 10 mmol/500 ml

- Dextrose 10% 500 ml bag
- NaCl 30% 15.0 ml
- KCl 10 mmol

Insulin Prescribing Tips

- Calculate Insulin Total Daily Dose (TDD) by adding ALL insulin taken in a typical 24-hour period
- NEVER abbreviate the term “UNITS” by writing “U”, “IU”, etc.
- Humalog Mix 25 is a TYPE, not a DOSE, and different from Humalog!
- Write out fractional doses fully: e.g., “2.5 (TWO POINT FIVE) UNITS”.
- Always download the latest version of this Guideline from the following web-site URL:
http://www.ggc-youngdiabetes.org/for_nhs_staff.html#goto-anchor-1591026074740

Diabetes Service Contact Numbers

- Diabetes Service Office (T: 0141 201 0331 / 80331)
- Diabetes Nurse Specialist (T: 0141 452 4646 / 84646)
- Diabetes/ Endocrinology Registrar (T: 18301)

Flow Chart of Management of Diabetes Patients during Surgery

