The Management of Diabetes Mellitus during Surgery

To be read in conjunction with Flow Chart overleaf

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 any complications such as infection.

All of these metabolic effects are exaggerated in the diabetic, particularly where there is a virtual absence of endogenous insulin. The pronounced catabolism results in fatty acid production, ketogenesis, hyperglycaemia and eventually to ketosis or ketoacidosis.

Controversy exists about the optimal management programme for diabetes during surgery and no large scale comparative studies have been done. The following protocol represents a compromise between various options

- **The anaesthetist must be consulted for a decision on whether the proposed procedure is minor or not.**
- **Ensure all relevant staff know that the child has diabetes.**
- **Check that the ward has a supply of - blood glucose meter testing strips, soluble insulin, insulin detemir**
  - **Lucozade.**
- **Normally, child should be admitted the day before an elective procedure even for afternoon lists**

Minor procedures only

Anaesthetic will be for less than 20 minutes duration (e.g. removal of long line, dental extraction)
While routine Diabetic Team review is not essential, please contact us (Tel: 80331 or80407) or the anesthetist with any concerns

- Target range for capillary blood glucose (CBG) levels is 4 – 10 mmol/l.
- CBG < 4 mmol/l (hypoglycaemia) should be treated immediately as follows:
  - *If tolerating oral intake:* oral glucose (Lucozade or Hypostop), then by longer-acting carbohydrate (e.g. a digestive biscuit)
  - *If nil by mouth :* increase infused glucose concentration (see Information Box below)
- CBG > 15 mmol/l requires urinalysis for possible ketonuria.
  - *If negative, trace or small ketonuria*: no further action required except continued monitoring.
  - *If moderate or large ketonuria*: seek further advice (contact Diabetes Team).

Pre-op

Morning list (NB Patient must be first on the list)

- Normal insulin on the DAY BEFORE surgery (e.g. Before Tea insulin, and Before Bed insulin if taken)
- Fast from 12 midnight
- **20%** of total daily dose as long acting analogue (**insulin detemir**) s.c. when putting up fluids
- **[If patient takes detemir at bedtime, and had it the night before, then reduce morning detemir to 10% of total daily dose]**
- IV fluids (NaCl 0.45% with Dextrose 5%) at maintenance rate, starting at between 0800 and 0830

Afternoon list (NB Patient must be first on the list)

- Normal insulin on the DAY BEFORE surgery (e.g. Before Tea insulin, and Before Bed insulin if taken)
- **20%** of total daily insulin dose as long acting analogue (**insulin detemir**) AND **10%** of total daily dose as **soluble insulin** (e.g. Actrapid) before breakfast
- Give breakfast on morning of surgery, then FAST thereafter
- IV fluids (NaCl 0.45% with Dextrose 5%) at maintenance rate, starting at between 0800 and 0830
- Monitor capillary blood sugars HOURLY from time of giving insulin

Post-op

If patient is to eat and drink within the first post-op 2 hours then simply prescribe subcutaneous insulin as follows:

- If eating LUNCH - Give **20%** of total daily dose as SOLUBLE insulin (e.g. Actrapid) AFTER lunch (to ensure patient eats).
- If eating TEA - Return to normal insulin regimen but give first dose AFTER child has eaten in case of refusal/vomiting.
- Once eating/drinking satisfactorily, IV fluids can be stopped.
- Continue monitoring capillary blood glucose as often as necessary until stable.

If patient is **not** to eat and drink, the following **Glucose/Potassium/Insulin (GKI) infusion** is necessary:

- Make up a solution of NaCl 0.45% with Dextrose 10%]
  + 10 mmol KCl]
  + 10 Units soluble insulin]

To make up **NaCl 0.45% with Dextrose 10%**
add 7.5 ml NaCl 30% to a bag of
500 ml Dext 10%

- Infuse at maintenance rate
- Monitor capillary blood sugars **hourly** until fully alert, *then* **every 2 hours** until restarted on subcutaneous insulin
  - If blood glucose 22 or above - increase Insulin concentration in IV Fluids to 16U/500 ml
  - If blood glucose 6 or less - decrease Insulin concentration in IV Fluids to 8U/500 ml

The above regimen is adequate for most minor elective surgical procedures, providing adequate diabetic control 24 hours post-op. If for any reason IV fluids are required for greater than 24 hours, a regimen tailored to the individual patient will be required.

More complex elective and emergency surgery should be managed using the protocol overleaf.

More Complex Surgery and Emergency Procedures

These cases should be discussed with the anaesthetist and a member of the Diabetes Service.

Best managed with: - continuous insulin infusion, *and*] as in the management of diabetic ketoacidosis.
- separate IV fluids]

NB. An anti-siphon/anti-reflux valve should be incorporated in the line if both going into the same cannula

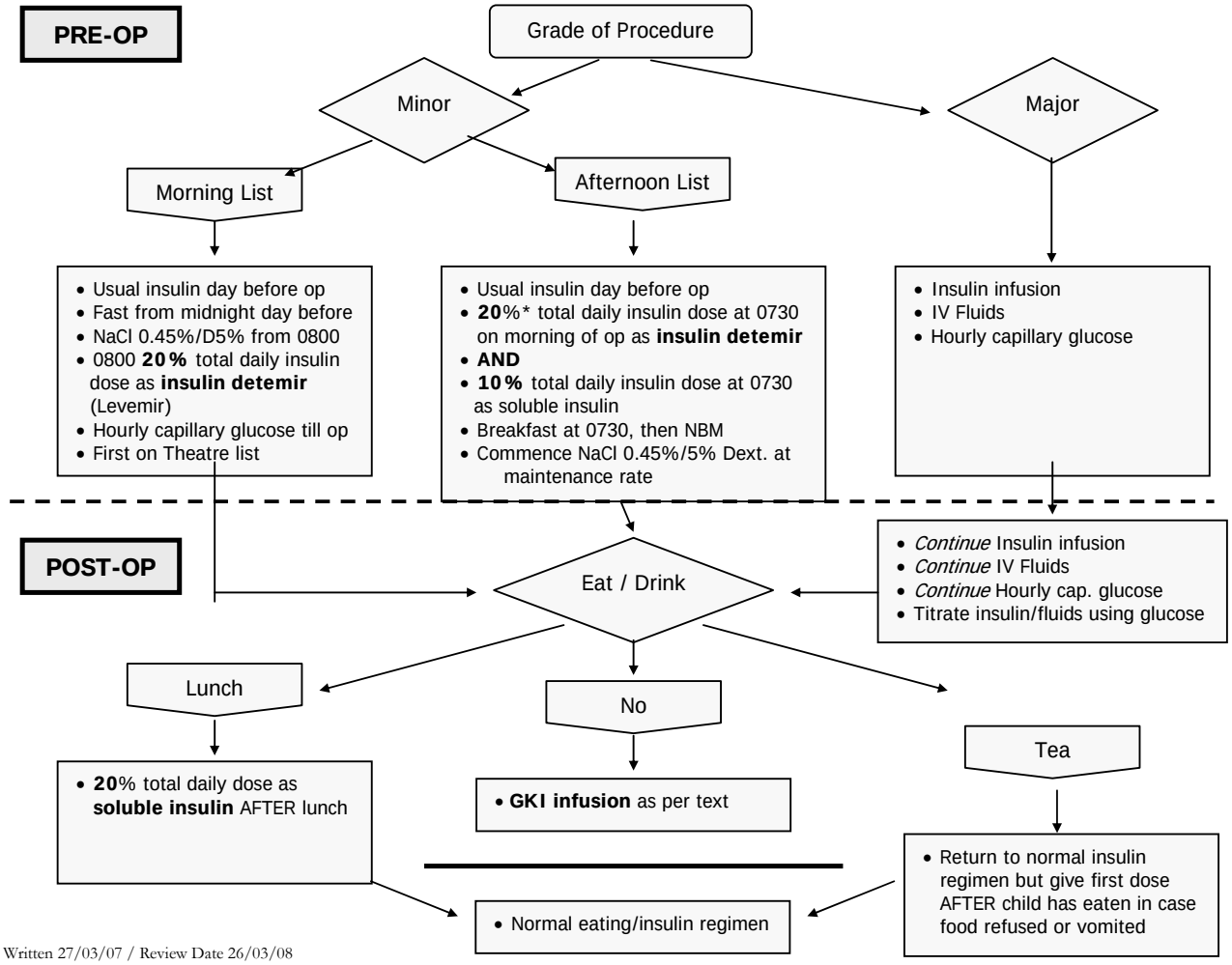
For a patient in good metabolic control and with normal electrolytes:

- Make up a solution of Soluble (clear) Insulin 1 Unit/ml (50U/50ml) NaCl 0.9%
  - using an insulin syringe, add 50 units soluble insulin (e.g. Actrapid) 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:
    0.05 units (ml)/kg/hr if blood glucose *less than 15 mmol/l*
    0.1 units (ml)/kg/hr if blood glucose *equal to or more than 15 mmol/l*
- Make up IV fluids using NaCl 0.45% and 5% dextrose
  - add 10 mmol KCl / 500ml IV fluid
  - infuse IV fluids at **2.5 ml/kg** body weight / hour
- Check Capillary blood glucose **hourly** before, during, and after operation/procedure (more frequently if clinically concerned)
- **Do *not* stop the insulin infusion completely** unless there are problems with persisting hypoglycaemia - this should be only for a short period, until reestablishing on fluid with increased dextrose concentration (e.g., NaCl 0.45% with 10% dextrose)

REMEMBER to let a member of the Diabetes Service and the anaesthetist know if you are embarking on this protocol

- Phone Diabetes Service - 80331 or
  - 80407
- Page Dr Gallacher - 2253
  Dr. Robertson - 2066
  Dr. Craigie - 2213

Diabetes & Surgery Flow Chart (to be used in conjunction with above text)



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* If patient takes bedtime detemir, and took it the night before, then give 10% of total daily dose as detemir