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Diabetes - Peri-operative Management

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Purpose:

To minimize interruption to glycaemic control throughout hospital admission for surgery including invasive diagnostic procedures.

Details:

1. **Context**

To minimize interruption to glycaemic control throughout hospital admission for surgery including invasive diagnostic procedures

2. **Definition of terms**

Type 1 Diabetes – auto-immune disease characterized by absolute insulin deficiency.

Type 2 Diabetes – genetic lifestyle disorder treated with lifestyle modification and often requiring oral hypoglycaemic agents (OHAs).

Oral Hypoglycemic agents (OHAs):

Secretagogues – sulfonylureas e.g. gliclazide, glimepiride, glibenclamide.

Sensitisers – metformin and glitazones e.g. rosiglitazone

Dipeptidyl Peptidase 4 (DPPIV) inhibitors – eg sitagliptin, linagliptin, saxagliptin, vildagliptin

Sodium-glucose cotransporter (SGLT)-2 inhibitors

Glucagon-like Peptide (GLP)-1 agonists – Exenatide (Byetta, Bydurion) Liraglutide

Basal bolus regimen – Quick or rapid acting insulin pre-meals and intermediate or long acting once daily.

BGL- Blood glucose level.

3. **Name of Standard to which Guideline / Procedure / Protocol relates**

Appropriate and effective care

4. **Processes**

PRE-OPERATIVE ASSESSMENT

The goal of pre-operative assessment is to assess the degree of control of diabetes and that control meets the criteria under which surgery should proceed. Pre-operative assessment should also document the management plan for diabetics before during and after surgery and determine the presence of diabetes complications that may influence the outcome of surgery. High risk patients should be planned for endocrine review pre-operatively and this may necessitate admission the day before planned surgery.

· Determine the type of diabetes and its management.

· Ensure that the patient's diabetes is well controlled (Hba1c <9.0%).

o If Hba1c is > 9.0% surgery should be postponed and endocrine outpatient review organized to optimize control. In cases where surgery is deemed essential, discussion with the Endocrinology Registrar should occur.

o If Hba1c is >8.0% and < 9.0% surgery can proceed but endocrine review peri-operatively is recommended as these patients will have more perioperative hyperglycaemia and are more prone to complications

· Ensure that the patient is capable of managing their diabetes after discharge from hospital.

· Consider the presence of complications of diabetes that might be adversely affected by or that might adversely impact upon the outcome of the proposed procedure. These include:

o Autonomic neuropathy

o Gastroparesis

o Silent myocardial ischaemia

o Diabetic nephropathy

The anaesthetic team should be made aware of these complications if present.

TARGETS FOR THERAPY

· Postpone elective surgery if possible if glycaemic control is poor (HbA1c ≥ 9%).

· BGL should be kept between 5 – 10mmol/l during the peri-operative period

· For critically ill patients who require admission to the intensive care unit post-operatively, a "tighter" BGL target (eg 4.4-6.1 mmol/L) may not convey any greater benefit and may be harmful.

· Hypoglycaemia must be avoided.

Insulin -glucose infusions

For patients who require insulin glucose infusion see the dedicated protocol

Insulin infusion protocol Policy 1971

PERI-OPERATIVE MANAGEMENT

Patients Managed On Diet Alone:

- Monitor BGL on a 4 times daily schedule prior to surgery, 2 hourly for 8 hours post-operatively and on a 4 times daily (6 hourly if nil orally and tds before meals and nocte if eating) schedule thereafter.

- If BGL > 12 mmol/L on two occasions then refer to “Patients Managed with Insulin” (below).

Patients Managed With Oral Hypoglycaemic Medication:

- Omit oral hypoglycaemic medications on morning of procedure. It is the medical staff’s responsibility to see that the drug chart clearly indicates that these medications should be withheld.

Note: diabetic patients who are fasting should not drive themselves to hospital because of the risk of hypoglycaemia.

- Monitor BGL on a 4 times daily schedule prior to surgery, 2 hourly for 8 hours post-operatively and on a 4 times daily schedule thereafter.
- If BGL > 12 mmol/L on two occasions then refer to “Patients Managed with Insulin” (below).
- If BGL < 4 mmol/L commence IV dextrose infusion (5% dextrose 100ml/hour (if the additional fluid load is an issue 10% dextrose at 50 mL per h may be substituted)) until patient is eating or BGL > 12 mmol/L. Check BGL in one hour and then 2 hourly until stable.
- Return to pre-operative oral hypoglycaemic medication regime once tolerating diet. Ensure normal renal function (eGFR>50 mls/sec) prior to recommencing metformin. Temporary insulin therapy may be appropriate if the patient is unwell or septic.

Patients on Sodium Glucose co-transorter 2 inhibitor therapy.

Evidence is emerging that these patients may be at risk of ketoacidosis if subjected to fasting and catabolic stress. These medications should be withheld in all patients during the perioperative period until oral intake is well established

Because of the difficulty managing fasting for long period during the day, patients with diabetes should be scheduled on a morning list.

NOTE: Many hypoglycaemic medications have a prolonged duration of action and may cause hypoglycaemia up to 48 hours after they have been discontinued if the patient is unable to resume eating.

Metformin

Metformin and Surgery

• For major surgery, Metformin should be stopped on the day of surgery and recommenced if serum creatinine level does not deteriorate post-operatively.

• Prolonged cessation of Metformin will result in deterioration of glycaemic control and additional anti-hyperglycaemic treatment will be required.

• Metformin need not be stopped for minor surgery.

Patients Managed With Insulin:

(Including patients with type 1 diabetes, insulin requiring type 2 diabetes and patients managed with diet or oral hypoglycaemic agents who have hyperglycaemia [BGL>12 mmol/L])

NOTE : Patients with type 1 diabetes always need insulin even when fasting.

For patients who are insulin requiring the ***safest approach is to use a glucose insulin infusion during the perioperative period***. The alternative approach using intermittent subcutaneous insulin with or without dextrose infusion usually delivered by ‘sliding scale’ leads to greater glucose variability, more hypo and hyperglycaemia, and in type 1 diabetes carries a greater risk of ketoacidosis. Haemodynamic changes during surgery make subcutaneous insulin absorption unreliable and so an intravenous infusion of insulin is preferred. The exception is well controlled insulin-requiring patients undergoing minor procedures where the patient is expected to be able to resume normal eating within 4 hours.

Morning List

- Patients should take their usual dose of insulin (as well as OHG) on the day prior to surgery, and fasting usually begins at midnight**.** Patients should be allocated first on the list if possible.

Note: diabetic patients who are fasting should not drive themselves to hospital because of the risk of hypoglycaemia. Patients should not take insulin before leaving home but bring their insulin with them for administration after arrival.

Major Surgery

Major surgery is defined, for the purposes of these guidelines, as any surgical procedure that requires an overnight admission to hospital and following which the patient will not resume normal diet for more than 4 hours.

- Maintain the usual insulin doses and diet the day before, and fast from midnight.
- Omit usual morning insulin (and OHA if taken as combined therapy with insulin)
- Commence an insulin-glucose infusion prior to induction of anaesthesia (or by 1000hrs at the latest).
- Measure BGL at least hourly during the intra-operative period.
- Continue the insulin-glucose infusion for at least 24 hours post-operatively **and** until theatient is capable of resuming an adequate oral intake.

Lantus (insulin glargine)

In patients receiving an evening injection of Lantus insulin, given its prolonged duration of action, the initial insulin infusion rate should be reduced by 50% for at least the first 2 hours of the I-G infusion and the rate then adjusted according to the BGL. Should the pre-operative BGL be ≥8 mmol/L however, then the insulin infusion should be commenced at the usual rate. For patients receiving a morning injection of Lantus insulin, then the insulin infusion should be commenced at the usual rate.

Minor Surgery

For minor surgery, ie day-only procedures, given the short duration of surgery, the impact on glycaemic control is minimal due to quick recovery and early resumption of the patients usual diet.

If the procedure is to be completed and the patient is ready to eat by 1030hrs

- Delay the usual morning dose of insulin. The patient can then have a late breakfast after the usual dose of insulin is given.

If the procedure will not be completed by 1030hrs and/or the patient will not be able to eat until after 1030hrs

- Give a half dose of insulin in the morning in the form of intermediate or long-acting insulin if possible (**see table 1 below**).
- If the BGL remains elevated (>12 mmol/l), a supplementary dose of short acting insulin subcutaneously will usually suffice. If recovery is prolonged an insulin/glucose infusion may be required.

Afternoon List

Afternoon procedures are not ideal for insulin-treated patients as they are more disruptive to their glycaemic control. Patients usually commence fasting from 0600hrs (or sometimes 0800hrs) for the procedure after an early light breakfast. It is therefore necessary to provide a dose of insulin capable of both preventing hyperglycaemia as well as avoiding hypoglycaemia at a time when the patient is not able to consume oral carbohydrate to treat hypoglycaemia should it occur. If glycaemic control is unstable, then admit earlier and use an insulin glucose infusion.

Major Surgery

- Give a reduced dose of insulin before early breakfast in the morning (**see table 2**).
- Patients should arrive by 0900hrs and BGLs should be monitored closely
- A 5% dextrose infusion (100mls per hour) should be commenced for support during fasting
- Commence an insulin infusion before induction of anaesthesia.

Minor Surgery

- Pre-operative insulin adjustments similar to that for major surgery in the afternoon (**Table 1**).

· Dextrose 5% (100mLs per hour) should be commenced after arrival in the ward.

· An insulin-glucose infusion may be necessary if pre-operative insulin adjustments result in hyperglycaemia.

· Overnight admission may be necessary for those with glycaemic instability or who are unable to resume their usual diet before discharge

Table 1. Day of procedure management for minor procedures where normal eating *not* likely to commence by 10.30 am. and for minor procedures delayed to the afternoon.

Commence 5% dextrose at 100ml/hour and administer insulin doses as below:

Insulin Type	**Morning insulin**	**Recommendation**		
		AM (minor) **Eating by 10.30 am**	**AM (minor)** **Not eating by 4 hours post procedure**	**PM (minor)(light breakfast)**
Ultra short or Short acting tds before meals (basal bolus)	Novorapid *(insulin aspart)* Humalog *(insulin lispro)* Apidra *(insulin glulisine)* Actrapid *(regular insulin)* Humulin R *(neutral insulin)*	Withhold morning of surgery Give with food as soon as possible post procedure No dextrose required	Administer ½ mane dose as short acting insulin Commence 5% dextrose at 100ml/hour	With light breakfast Administer ½ mane dose as short acting insulin Administer ½ lunch dose if no basal insulin was given mane Commence 5% dextrose at 100ml/hour
Intermediate **Basal** **Long Basal**	Protaphane *(isophane insulin)* Humulin NPH *(isophane insulin)* Levemir *(insulin detemir)* Lantus *(insulin glargine)*	Administer ½ mane dose Feed post-procedure and monitor BGL	Administer ½ mane dose as intermediate acting insulin Commence 5% dextrose at 100ml/hour	Administer ½ mane dose as intermediate acting insulin Commence 5% dextrose at 100ml/hour
Pre-mixed **Or** **a combination of short and long acting insulin given as separate injections**	Novomix 30 *(insulin aspart/protamine)* Humalog Mix 25 *(insulin lispro/protamine)* Humalog Mix 50 Mixtard 30/70 *(regular insulin/isophane)*	Administer ½ total mane dose as intermediate-acting basal insulin (ie protaphane)	Administer ½ total mane dose as intermediate-acting basal insulin (ie protaphane) Commence 5% dextrose at 100ml/hour	Administer ½ total mane dose as premix Commence 5% dextrose at 100ml/hour

Table 2 Suggested management of patients with insulin-requiring diabetes prior to major surgery

Insulin type	**Morning insulin**	**Recommendation**	
		Major surgery Morning list	**Major surgery afternoon list**
Ultra short or Short acting tds before meals (basal bolus)	Novorapid *(insulin aspart)* Humalog *(insulin lispro)* Apidra *(insulin glulisine)*	Omit Morning Insulin Commence Insulin infusion before surgery and before 10 am.	With light breakfast Administer ½ mane dose Administer ½ lunch dose if no basal insulin was

	Actrapid *(regular insulin)* Humulin R *(neutral insulin)*	Commence 5% dextrose 100ml/hr simultaneously.	given mane Commence 5% dextrose at 100ml/hour Commence insulin infusion prior to surgery
Intermediate **Basal** **Long Basal**	Protaphane *(isophane insulin)* Humulin NPH *(isophane insulin)* Levemir *(insulin detemir)* Lantus *(insulin glargine)*	Omit Morning Insulin Commence Insulin infusion before surgery and before 10 am. Commence 5% dextrose 100ml/hr simultaneously.	Administer ½ mane dose Commence 5% dextrose at 100ml/hour Commence insulin infusion prior to surgery
Pre-mixed	Novomix 30 *(insulin aspart/protamine)* Humalog Mix 25 *(insulin lispro/protamine)* Humalog Mix 50 Mixtard 30/70 *(regular insulin/isophane)*	Omit Morning Insulin Commence Insulin infusion before surgery and before 10 am. Commence 5% dextrose 100ml/hr simultaneously.	Administer ½ mane dose as intermediate insulin (protaphane) Commence 5% dextrose at 100ml/hour Commence insulin infusion prior to surgery

Post-procedure management

All patients should have BGL monitored 2 hourly for 8 hours and then 6 hourly (or premeals and before bed if eating) thereafter. Maintain the insulin infusion with glucose support until patient eating. Once eating, the patient is converted to a basal bolus regimen totaling 2/3 total insulin infused dose given as 1/6 dose rapid acting insulin before meals three times per day and ½ as basal long or intermediate acting insulin at night. A small dose (4-6 units) of short acting insulin should be prescribed as a correction bolus to be given if the BGL in > 12 mmol/L three times per day before meals. The basal bolus regimen is adjusted daily to reduce the need for correctional boluses. The patient is returned to their usual regimen, including any OHA, used when stable.

Continuous subcutaneous insulin infusion (Insulin pumps)

These pumps can be used for minor procedures but are not appropriate for major surgery.

The continuation of the insulin pump during the surgery should be discussed with the proceduralist and anaesthetist.

For minor or day-only surgery, the pump can be continued at **the usual basal insulin infusion rate**, but this must be discussed with the anaesthetist in advance.

BGLs must be monitored hourly during the procedure. For major surgery, due to potential intra-operative fluctuations in haemodynamic status, subcutaneous absorption of insulin may vary, and counter regulatory hormone release may increase insulin requirements. Therefore, as patients will also not be able to manage the pump themselves during and immediately after surgery, an insulin infusion should be used instead.

Bowel preparation for colonoscopy.

2 days prior to procedure

If required to have a modified diet take

On OHAs: continue therapy and monitor BGL four times a day

On insulin: administer two thirds of usual dose on this day and monitor BGLs four times a day.

Treat hypoglycaemic episodes with sugar containing clear fluids (eg apple juice)

Day prior to procedure (bowel prep)

Include at least four glasses of glucose-containing cordial drinks (no red coloring) throughout the day

On OHAs: withhold suphonylureas (gliclazide, glipizide, glibenclamide) and DPPIV inhibitors (sitagliptin, vildagliptin, saxagliptin, alogliptin, linagliptin) for duration of fasting. Metformin and thiazolidinediones (pioglitizone, rosiglitazone) may be given

On insulin: administer half of usual dose on this day and monitor BGLs four times a day. Treat hypoglycaemic episodes with sugar containing clear fluids (eg apple juice)

Day of procedure

Management is as for minor procedures above.

Note: diabetic patients who are fasting should not drive themselves to hospital because of the risk of hypoglycaemia. Patients should not take insulin before leaving home but bring their insulin with them for administration after arrival.

Preferably schedule patient early on list

Monitor BGLs every 6 hours

Patients managed with diet alone

No additional special preparation is required

Patients managed with OHAs

Withhold mane OHAs

Monitor BGLs every 6 hours

Patients treated with insulin

If AM list:

If the patient is to be eating by 10 am then withhold insulin and recommence usual regimen with a delayed breakfast after the procedure.

If the patient won't eat until lunch, Give half of the morning insulin dose as intermediate acting insulin (NPH, Protaphane). If hypoglycaemia is a concern or if the case is delayed, establish an IV 5% dextrose line on admission

If PM list: Give two thirds of morning and lunchtime dose as isophane insulin. Commence IV 5% dextrose over 8 hours. Resume normal insulin regimen at evening meal time.

All people with diabetes

After procedure, a light meal is to be provided and the IV (if required) discontinued when eating is re-established.

That night, the patient should have normal diet and medications.

Contact Endocrine Registrar, Endocrinologist or Physician for further information.

5. **Scope**

All clinical Staff

6. Tools & Techniques

Nil

7. References

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