Peri-operative Glucose Control: When and How

Dr Judith Killen
Wagga Wagga
References:

- Peri-operative management for the surgical patient with diabetes 2015 Guideline from the AAGBI
- Insulin: Understanding its role in health and disease. Sonksen & Sonksen BJA July 2000
- Endotext.org
Banting memorial Lecture 2010
David Matthews

- Type 2 diabetes: the Black Death of the 21\textsuperscript{st} Century
- Today there is a new scourge, but of a chronic rather than an acute disease.
- We understand much about the background and spread of this epidemic. We have detailed epidemiological maps; we recognise obesity as the prodrome to diabetes; we discuss the time course of this epidemic and we quantify its prevalence.
Fast Food

- Worth $6 billion in 1970 in the US alone
- Worth over $200 billion in the US today
- Negative impacts include diet related diseases, worker exploitation, systemic animal abuse and environmental degradation.
- Clustered around schools
- Profit rules
The Cost of Diabetes Care

- 20 billion pounds per annum in the UK
- Diabetes drugs cost the NHS about 1 million pounds per hour.
- Much of this could be used in better ways
Real Costs; Real Value

- An article in The Economist Sept 14, 2015 compared 10 countries spending on various categories.
- The US spends the least on food (6.8%) and the most on healthcare (20.9%)
- Good food costs more
- Diabetes drugs are expensive and have mostly only been shown to reduce HbA1c, not increase longevity or reduce complications of diabetes.
Comparison to Smoking

- 20-30% of people will follow good advice.
- Advice needs to be accurate
- Advice needs to be consistent.
- Advice needs to be frequent
- Plain packaging
- No sports sponsorship
- No advertising
Now for the Surgical Patient

- DM affects 10-15% of the surgical population
- Patients with DM require more surgery
- Higher mortality, higher MI rates, higher SSI rates, higher LOS.
- Complex polypharmacy issues
- Inadequate guidelines
Preparing for Surgery

- Adequacy of diabetes control
- Presence of complications
- Monitoring for complications
- Possibility of undiagnosed diabetes
PBLD 10A
Glucose Control Poll Results
PBLD 10B
Glucose Control Poll Results
Pre-operative Assessment

- Optimise glycaemic control; HbA1c should be less than 68 mmol/mol
- Renal function – annual 24 hour urine collection for albuminuria. Creatinine may be normal with significant nephropathy
- Ischaemia – cardiac, cerebral, renal, peripheral
- Neuropathy – autonomic and somatic
- Hypo point
### HbA1c

#### 50 Shades of Diabetes

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<th>31</th>
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HbA1c

- The amount of aged glycation end product (AGE) attached to the HbA molecule
HbA1c

- Used to be reported as a percentage
- Now as mmol HbA glycated / mol HbA
- “Average” BGL was about 2xHbA1c % - 6
- Now average BGL is about 0.1 plus 1.7
- Affected by anaemia, haemaglobinopathies, etc
Presence of Complications

- Cardiac – macro and micro vascular, diabetic “stiff” heart, autonomic neuropathy
- Renal – compromised, possibly ESRF and dialysis
- Neurological – delayed gastric emptying, chronic pain
- Musculoskeletal – stiff joints
Monitoring of Complications

- Usual GP monitoring – HbA1c up to 3 monthly, usual BP and pathology
- Annual eye checks
- Annual foot checks
- Annual 24 hour urine
- 5 yearly stress tests
Possibility of Undiagnosed Diabetes

- It is widely considered that there are many undiagnosed T2Ds
- Hyperglycaemia in hospital with no previous diagnosis of DM has high complication rates
- A recent BJA article has suggested doing HbA1cs on all patients presenting for major surgery
- Alternatively, assess risk with points for family history, age, gender, ethnicity, BMI, exercise level.
Should Everyone Have an HbA1c?

Hyperglycemia and Hospital Mortality

* * * 0.01 compared with normoglycemia and known diabetes.

Planning Admission

- Minimise the Fasting Period
- Ensure normoglycaemia
- Minimise disruption to the patient’s usual routine
- Ideally first on am list
- Appropriate modification of usual routine with written instructions
- Management plan for untoward hypo or hyperglycaemia
Management of Existing Therapy – Insulin

- Balance insulin – food – exercise triad
- Always provide basal insulin in T1D – long acting or basal rate with pumps
- Reduce basal rate or long-acting dose if prone to low am BGL readings
- Reduce mixed insulins by up to 50% or give slightly later for short procedures
Different Insulins, Different Pharmacokinetics

<table>
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<th>Insulin</th>
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<tr>
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<td>60-90 mins</td>
<td>4.5 hours</td>
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<tr>
<td>Humalog</td>
<td>30-60 mins</td>
<td>2-4 hours</td>
<td>5.8 hours</td>
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<tr>
<td>NPH</td>
<td>1.3 hours</td>
<td>5-6 hours</td>
<td>12-18 hours</td>
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<td>Le vemir</td>
<td>90 mins</td>
<td>Relatively peakless</td>
<td>12-24 hours</td>
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<tr>
<td>Lantus</td>
<td>90 mins</td>
<td>Peakless</td>
<td>24 hours</td>
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Multiple Daily Injections

- Match food and insulin but risk of early am hypoglycaemia
Insulin Pump Delivery of Insulin

- Pumps can alter the basal delivery rate as well as the prandial
Mixed Insulins

- Mixed insulins dictate regular food intake.
Management of existing Oral Therapy

- Over 70 brands available, some are dual therapy
- 7 main drug groups.
- Some cause hypoglycaemia, most don’t
- Probably easiest and least error prone to say “omit tablets, bring them with you.”
Oral Medications

- Meglitinides
- Sulphonylureas
- SGLT-2 inhibitors
- Acarbose
- DPP-4 inhibitors
- Metformin
- Proglitazones
Non-insulin Injectables

- GLP-1 analogues – exenatide, given either daily or as a weekly slow release injection
- amylin
Fasting

- 6 hours for food; 2 hours for clear fluids
- This allows ingestion of fluids such as apple juice to treat hypoglycaemia prior to admission
- Advise patients to check their BGL hourly and let staff know on arrival if trending down and requiring IV dextrose
- Aim for BGL 7.5 +/- 2.5 unless this is below the patient’s “hypo” point
- Aim for glycaemic stability
Intra-operative Monitoring

- Continue hourly BGLs for all patients on insulin
- Aim for tram tracks
- More frequent BGLs if changing rapidly or outside the target range and correction given
- Check ketones of patients with T1D and hyperglycaemia
Resume Normal management

- Resume normal diet asap
- This allows resumption of normal medications
- Remember that patients will generally be less active after surgery, so may need less food
- Encourage appropriately frequent monitoring of BGL
Patients Unable to Eat Postoperatively

- Ensure a plan is documented
- Ensure someone is taking responsibility for the transitioning to normal management
- Be aware of the risk of DKA if basal insulin is not provided to patients with T1D
- Be aware of the risk of hypoglycaemia if an insulin infusion is not properly monitored
Safe Use of Insulin in Hospitals

- Wrong patient
- Wrong insulin
- Wrong dose
- Wrong time
- Dose mistakes are often 100 fold – ml instead of u/s
Delivery Systems for Insulin

- Insulin syringes
- Pens
- Insulin pumps
- Infusions loaded in the hospital
Insulin syringes & Pens

- Pens are brand specific
Insulin Pumps

- May come with continuous glucose sensors
Other Anaesthetic Issues

- Ideal to avoid nausea and vomiting but be aware that dexamethasone may affect glycaemic control.
- Regional anaesthesia may reduce narcotic requirement and therefore PONV.
- ERAS fluids are high carb and should be discontinued if the BGL exceeds the target range.
Emergency Surgery

- Insulin on board – be aware of hypoglycaemia
- Prioritise surgery to minimise fasting
- Provide basal insulin (Long acting could be due intra-operatively)
- Ensure adequate treatment plan
How to Give IV Dextrose

- 2.5% D + N/2 S
- 4% D + N/2 S
- 5% D
- 10% D
- 20% D
- 50% D
- Higher volumes of hyponatraemic fluids are problematic
“New Controversies”

- Utility of HbA1c
- Current suggestions include HbA1c on all patients having major surgery
- Use of metformin peri-operatively
- Dose of long-acting insulin peri-operatively
- Ideal BGL range
- Choice of IV fluids
- Use of dexamethasone
Old Messages

- Measure the BGL
- We are anaesthetists – we monitor
- Know what to do when the BGL is out of range
Thank You