Glycaemic Control in the Patient with Diabetes Undergoing Revascularisation or Peri-operative Glucose Control - Is it Important?

Dr Ketan Dhatariya  MSc MD MS FRCP
Consultant in Diabetes and Endocrinology
Norfolk and Norwich University Hospitals
Data from Public Health England

- People with diabetes are
  - Less likely to be offered day case surgery
  - More likely to have emergency surgery
  - Have a longer LOS following surgery
  - Have higher rates of 28-day readmissions following surgery

Last accessed 19\textsuperscript{th} April 2017
Do Peri-Operative High Glucose Levels Cause Harm?

- High pre-operative glucose or HbA1c has been related to adverse outcomes following
  - spinal surgery
  - vascular surgery
  - colorectal surgery
  - cardiac surgery
  - trauma
  - mastectomies
  - foot and ankle
  - neurosurgery
  - transplant surgery
  - HBP surgery
  - cholecystectomy
  - cardiac surgery

References:
- Walid MS et al J Hosp Med 2010;5:E10-E14
- O'Sullivan CJ et al Europ J of Vasc Endovasc Surg 2006;32:188-197
- Park C et al Transplantation 2009;87(7):1031-1036
- Shibuya N et al J Foot Ankle Surg 2013;52(2):207-211
- Sadoskas D et al Foot Ankle Spec 2016;9(1):24-30
Do High Glucose Levels Cause Harm?

3,184 unselected non-cardiac surgical patients in Atlanta, GA
20.2% known to have diabetes
7.9% had hyperglycaemia prior to surgery

All patients
- Patients with diabetes
- Patients without diabetes

Frisch A et al Diabetes Care 2010;33(8):1783-1788
Do High Glucose Levels Cause Harm?

3,184 unselected non-cardiac surgical patients in Atlanta, GA

- 17.2% of people had hyperglycaemia on the day of surgery (not known to have diabetes)
- 9.9% had post operative hyperglycaemia

Frisch A et al Diabetes Care 2010;33(8):1783-1788
Outcomes

High glucose levels were associated with poor outcomes

But – having diabetes was protective (?increased vigilance)

Observational data from 55 US hospitals over 5 years looked at the outcomes of 18,278 patients 11,633 of whom who had a BG measured pre op, on day 1 post op or day 2 post op
HbA1c and Outcome Post CABG

- 764 patients with T1DM undergoing CABG between 1997-2012 in Sweden
- For every 1% (9mmol/mol) rise in pre-operative HbA1c above 7% (53mmol/mol), there was an 18% increase in mortality or MACE

Benefits of Glucose Control Extend to Those Without Diabetes

- 2383 people undergoing cardiac surgery randomised to tight peri- or post-operative glycaemic control (4.4-6.1 mmol/l)

- Those without diabetes had the greatest benefit in reductions complications
  - CV
  - Pulmonary
  - Neurological
  - GI
  - Renal

Blaha J et al J Clin Endo Metabol 2015;100(8):3081-3089
What About ITU??
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Patients</th>
<th>No. pts</th>
<th>% Diabetes</th>
<th>Target blood</th>
<th>Glucose</th>
<th>Benefit</th>
<th>Outcome</th>
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</thead>
<tbody>
<tr>
<td>Adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IGC mg/dl</td>
<td>CGC mg/dl</td>
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<tr>
<td>Leuven I</td>
<td>2001</td>
<td>Surgical</td>
<td>1548</td>
<td>13</td>
<td>80–110</td>
<td>180–200</td>
<td>Yes</td>
<td>Reduced mortality, AKI, infections, LOS, increased hypoglycemia</td>
</tr>
<tr>
<td>Leuven II</td>
<td>2006</td>
<td>MICU</td>
<td>1200</td>
<td>17</td>
<td>80–110</td>
<td>180–200</td>
<td>?</td>
<td>NOB, reduced AKI, LOS, increased hypoglycemia</td>
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<tr>
<td>GLUCON TROL</td>
<td>2007</td>
<td>Mixed</td>
<td>1078</td>
<td>18</td>
<td>80–110</td>
<td>140–180</td>
<td>No</td>
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<tr>
<td>VISEP</td>
<td>2008</td>
<td>Mixed</td>
<td>537</td>
<td>30</td>
<td>80–110</td>
<td>180–200</td>
<td>No</td>
<td>NOB, increased hypoglycemia</td>
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<tr>
<td>de la Rosa</td>
<td>2008</td>
<td>Mixed</td>
<td>504</td>
<td>12</td>
<td>80–110</td>
<td>180–200</td>
<td>No</td>
<td>NOB, increased hypoglycemia</td>
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<tr>
<td>Arabi</td>
<td>2008</td>
<td>Mixed</td>
<td>240</td>
<td>40</td>
<td>80–110</td>
<td>180–200</td>
<td>No</td>
<td>NOB, increased hypoglycemia</td>
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<tr>
<td>Bilotta</td>
<td>2008</td>
<td>TBI</td>
<td>97</td>
<td>–</td>
<td>80–120</td>
<td>&lt;220</td>
<td>No</td>
<td>NOB, reduced LOS, increased hypoglycemia</td>
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<tr>
<td>Bilotta</td>
<td>2009</td>
<td>N/surgery</td>
<td>483</td>
<td>10</td>
<td>80–110</td>
<td>&lt;215</td>
<td>No</td>
<td>NOB, reduced LOS, reduced UTI, increased hypoglycemia</td>
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<tr>
<td>NICE-SUGAR</td>
<td>2009</td>
<td>Mixed</td>
<td>6022</td>
<td>20</td>
<td>80–110</td>
<td>&lt;180</td>
<td>No</td>
<td>HARM, increased mortality, increased hypoglycemia</td>
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<tr>
<td>COITSS</td>
<td>2010</td>
<td>Mixed</td>
<td>509</td>
<td>–</td>
<td>80–110</td>
<td>180–200</td>
<td>No</td>
<td>NOB, increased hypoglycemia</td>
</tr>
<tr>
<td>Coester</td>
<td>2010</td>
<td>TBI</td>
<td>88</td>
<td>–</td>
<td>80–110</td>
<td>&lt;220</td>
<td>No</td>
<td>NOB, increased hypoglycemia</td>
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<tr>
<td>INSULIN-FARCT</td>
<td>2012</td>
<td>Stroke</td>
<td>180</td>
<td>–</td>
<td>IIT</td>
<td>SIT</td>
<td>No</td>
<td>HARM, larger infarct growth</td>
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<tr>
<td>BIOMArCS-2</td>
<td>2013</td>
<td>ACS</td>
<td>280</td>
<td>10</td>
<td>85–110</td>
<td>&lt;288</td>
<td>No</td>
<td>HARM, composite of death and second AMI</td>
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<tr>
<td>CGAO-REA</td>
<td>2014</td>
<td>Mixed</td>
<td>2684</td>
<td>23</td>
<td>80–110</td>
<td>&lt;180</td>
<td>No</td>
<td>NOB, increased hypoglycemia</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vlasselaers</td>
<td>2009</td>
<td>Mixed</td>
<td>700</td>
<td>3</td>
<td>Infants (50–80)</td>
<td>214</td>
<td>Yes</td>
<td>Reduced LOS, infections, mortality, increased hypoglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Children (70–100)</td>
<td>214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECS</td>
<td>2012</td>
<td>C/surgery</td>
<td>980</td>
<td>–</td>
<td>80–110</td>
<td>No target</td>
<td>No</td>
<td>NOB</td>
</tr>
<tr>
<td>CHIP</td>
<td>2014</td>
<td>Mixed</td>
<td>1369</td>
<td>–</td>
<td>72–126</td>
<td>&lt;216</td>
<td>No</td>
<td>NOB, increased hypoglycemia</td>
</tr>
</tbody>
</table>

Marik PE Intensive Care Medicine 2016;42(9):1475-1477
Something Some of You May Have Seen

• Disappointingly, the word ‘diabetes’ appears only once, ‘hyperglycaemia’ and ‘glucose’ do not appear at all in this document.


Last accessed 17th April 2017
In 2011 Along Came This.....

http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm
And This.....

It Has Now Been Updated
It’s Part of the Anaesthetists Bible - GPAS

Guidelines

Peri-operative management of the surgical patient with diabetes 2015

Association of Anaesthetists of Great Britain and Ireland


¹ Joint British Diabetes Societies Inpatient Care Group
² British Association of Day Surgery
³ Royal College of Anaesthetists
National Guidelines

- Document divided into sections:
  - Primary care
  - Surgical outpatients
  - Pre-operative assessment clinic
  - Hospital admission
  - Theatre and recovery
  - Post-operative care
  - Discharge
<table>
<thead>
<tr>
<th>Insulins</th>
<th>Day prior to admission</th>
<th>Patient for AM surgery</th>
<th>Patient for PM surgery</th>
<th>If a VRIII is being used*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Once daily (evening)</strong> (e.g. Lantus® or Levemir® Tresiba® Insulatard® Humulin I® Insuman®)</td>
<td>Reduce dose by 20%</td>
<td>Check blood glucose on admission</td>
<td>Check blood glucose on admission</td>
<td>Continue at 80% of the usual dose</td>
</tr>
<tr>
<td><strong>Once daily (morning)</strong> (Lantus® or Levemir® Tresiba® Insulatard® Humulin I® Insuman®)</td>
<td>Reduce dose by 20%</td>
<td>Reduce dose by 20%</td>
<td>Reduce dose by 20%</td>
<td>Continue at 80% of the usual dose</td>
</tr>
<tr>
<td><strong>Twice daily</strong> (e.g. Novomix 30®, Humulin M3®, Humalog Mix 25®, Humalog Mix 50®, Insuman® Comb 25, Insuman® Comb 50 twice daily Levemir® or Lantus®)</td>
<td>No dose change</td>
<td>Halve the usual morning dose. Check blood glucose on admission Leave the evening meal dose unchanged</td>
<td>Halve the usual morning dose. Check blood glucose on admission Leave the evening meal dose unchanged</td>
<td>Stop until eating and drinking normally</td>
</tr>
<tr>
<td><strong>Twice daily - separate injections of short acting</strong> (e.g. animal neutral, Novorapid® Humulin S®, Apidra® and intermediate acting (e.g. animal isophane Insulatard® Humulin I® Insuman®))</td>
<td>No dose change</td>
<td>Calculate the total dose of both morning insulins and give half as intermediate acting only in the morning. Check blood glucose on admission Leave the evening meal dose unchanged</td>
<td>Calculate the total dose of both morning insulins and give half as intermediate acting only in the morning. Check blood glucose on admission Leave the evening meal dose unchanged</td>
<td>Stop until eating and drinking normally</td>
</tr>
<tr>
<td><strong>3, 4 or 5 injections Daily</strong> (e.g. an injection of mixed insulin 3 times a day or 3 meal time injections of short acting insulin and once or twice daily background)</td>
<td>No dose change</td>
<td>Basal bolus regimens: omit the morning and lunchtime short acting insulins. Keep the basal unchanged.* Premixed a.m. insulin: halve the morning dose and omit lunchtime dose Check blood glucose on admission</td>
<td>Take usual morning insulin dose(s). Omit lunchtime dose. Check blood glucose on admission</td>
<td>Stop until eating and drinking normally</td>
</tr>
<tr>
<td>Tablets</td>
<td>Day prior to admission</td>
<td>Patient for AM surgery</td>
<td>Patient for PM surgery</td>
<td>If a VRIII is being used*</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Acarbose</td>
<td>Take as normal</td>
<td>Omit morning dose if NBM</td>
<td>Give morning dose if eating</td>
<td>Stop once VRIII commenced, do not recommence until eating and drinking normally</td>
</tr>
<tr>
<td>Meglitinide (e.g. repaglinide or nateglinide)</td>
<td>Take as normal</td>
<td>Omit morning dose if NBM</td>
<td>Give morning dose if eating</td>
<td>Stop once VRIII commenced, do not recommence until eating and drinking normally</td>
</tr>
<tr>
<td>Metformin (eGFR is greater than 60ml/min/1.73m² and procedure not requiring use of contrast media**)</td>
<td>Take as normal</td>
<td>If taken once or twice a day – take as normal If taken three times per day, omit lunchtime dose</td>
<td>If taken once or twice a day – take as normal If taken three times per day, omit lunchtime dose</td>
<td>Stop once VRIII commenced, do not recommence until eating and drinking normally</td>
</tr>
<tr>
<td>Sulphonylurea (e.g. glibenclamide, gliclazide, glipizide, etc.)</td>
<td>Take as normal</td>
<td>Once daily am omit Twice daily omit am</td>
<td>Once daily am omit Twice daily omit am and pm</td>
<td>Stop once VRIII commenced, do not recommence until eating and drinking normally</td>
</tr>
<tr>
<td>Pioglitazone</td>
<td>Take as normal</td>
<td>Take as normal</td>
<td>Take as normal</td>
<td>Stop once VRIII commenced, do not recommence until eating and drinking normally</td>
</tr>
<tr>
<td>DPP IV inhibitor (e.g. sitagliptin, vildagliptin, saxagliptin, alogliptin, linagliptin)</td>
<td>Take as normal</td>
<td>Take as normal</td>
<td>Take as normal</td>
<td>Stop once VRIII commenced, do not recommence until eating and drinking normally</td>
</tr>
<tr>
<td>GLP-1 analogue (e.g. exenatide, liraglutide, lixisenatide, dulaglutide)</td>
<td>Take as normal</td>
<td>Take as normal</td>
<td>Take as normal</td>
<td>Take as normal</td>
</tr>
<tr>
<td>SGLT-2 inhibitors (e.g. dapagliflozin, canagliflozin)</td>
<td>Take as normal</td>
<td>Omit on day of surgery</td>
<td>Omit on day of surgery</td>
<td>Omit until eating and drinking normally</td>
</tr>
</tbody>
</table>
This 2014 report showed that diabetes played a big part in the risk of lower limb amputation.

For 2017-2019 one of their workstreams is the peri-operative management of adult patients with diabetes.
Glycaemic Control in the Patient with Diabetes Undergoing Revascularisation

or

Peri-operative Glucose Control - Is it Important?

www.norfolkdiabetes.com

ketan.dhatariya@nnuh.nhs.uk

@ketandhatariya