Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust


# Fasted and Consented but Blood Glucose 18mmol/L

## or How to Manage Diabetes in the Peri-Operative Period

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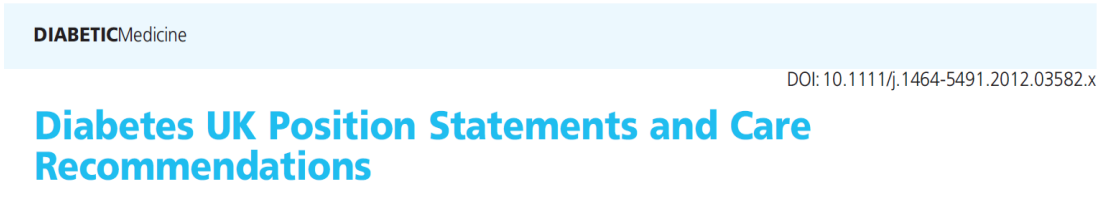
# A Few Disclosures

- This is a subject that has occupied me for the last several years and I tend to get a bit evangelical about it
- I'm one of the lead authors on these


DIABETICMedicine

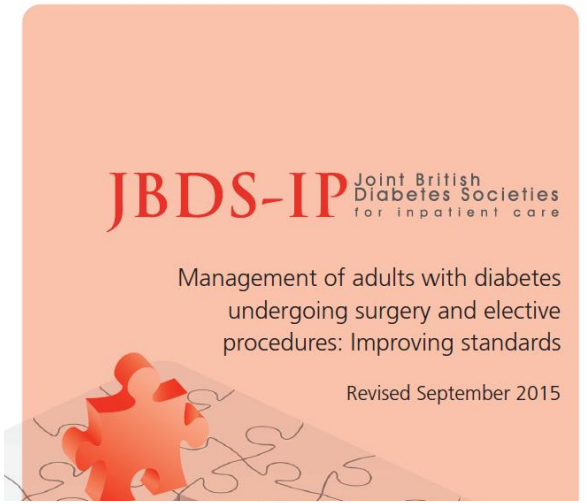
DOI: 10.1111/j.1464-5491.2012.03582.x

**Diabetes UK Position Statements and Care Recommendations**

**NHS Diabetes guideline for the perioperative management of the adult patient with diabetes***

K. Dhatariya[1], N. Levy[2], A. Kilvert[3], B. Watson[4], D. Cousins[5], D. Flanagan[6], L. Hilton[7], C. Jairam[8], K. Leyden[3], A. Lipp[1], D. Lobo[9], M. Sinclair-Hammersley[10] and G. Rayman[1] for the Joint British Diabetes Societies

Diabet. Med. 29, 420–433 (2012)




Anaesthesia 2015, 70, 1427–1440 doi:10.1111/anae.13233

Guidelines

Peri-operative management of the surgical patient with diabetes 2015

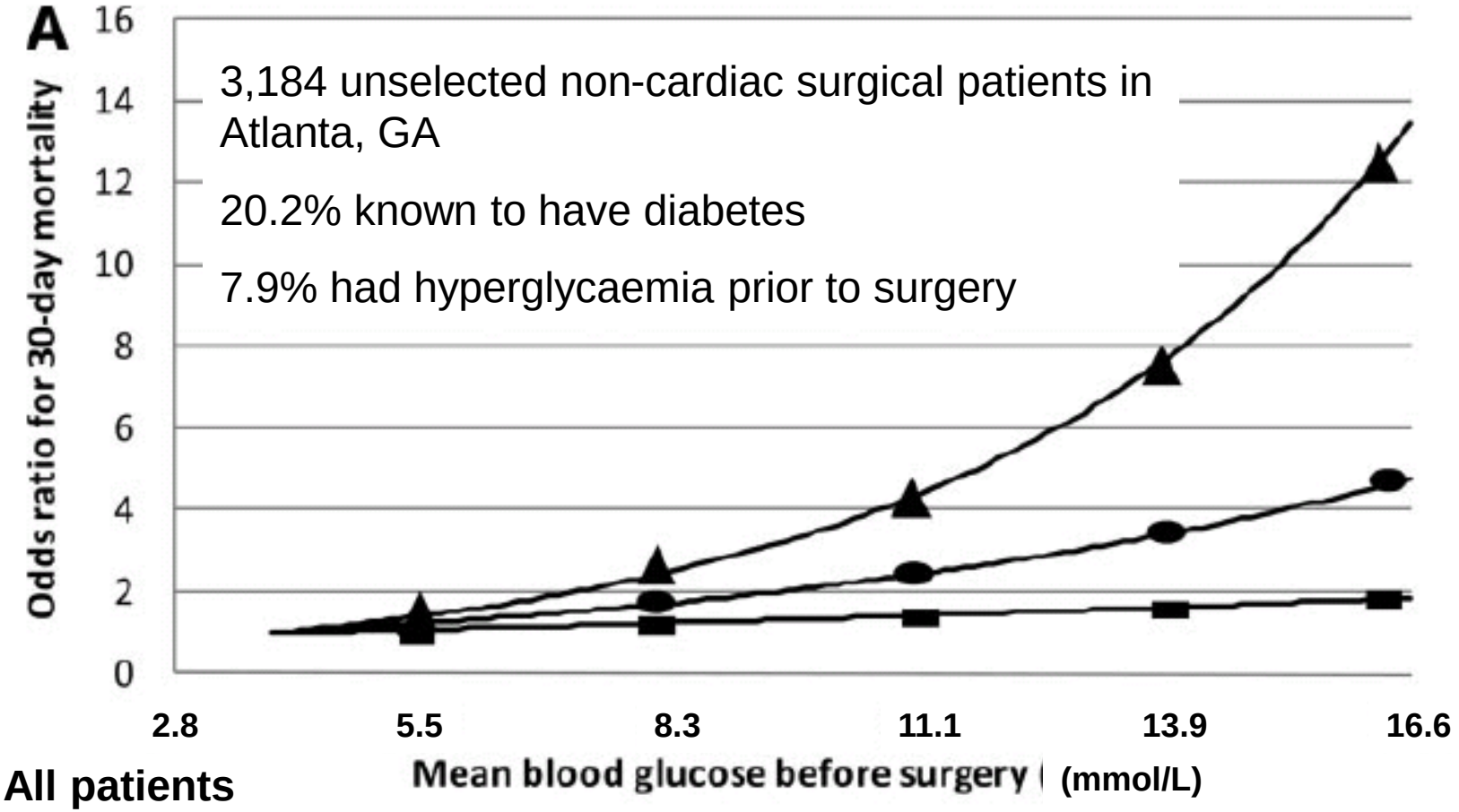
Association of Anaesthetists of Great Britain and Ireland

Membership of the Working Party: P. Barker, P. E. Creasey, K. Dhatariya,[1] N. Levy, A. Lipp,[2] M. H. Nathanson (Chair), N. Penfold,[3] B. Watson and T. Woodcock

# A Bit of Background

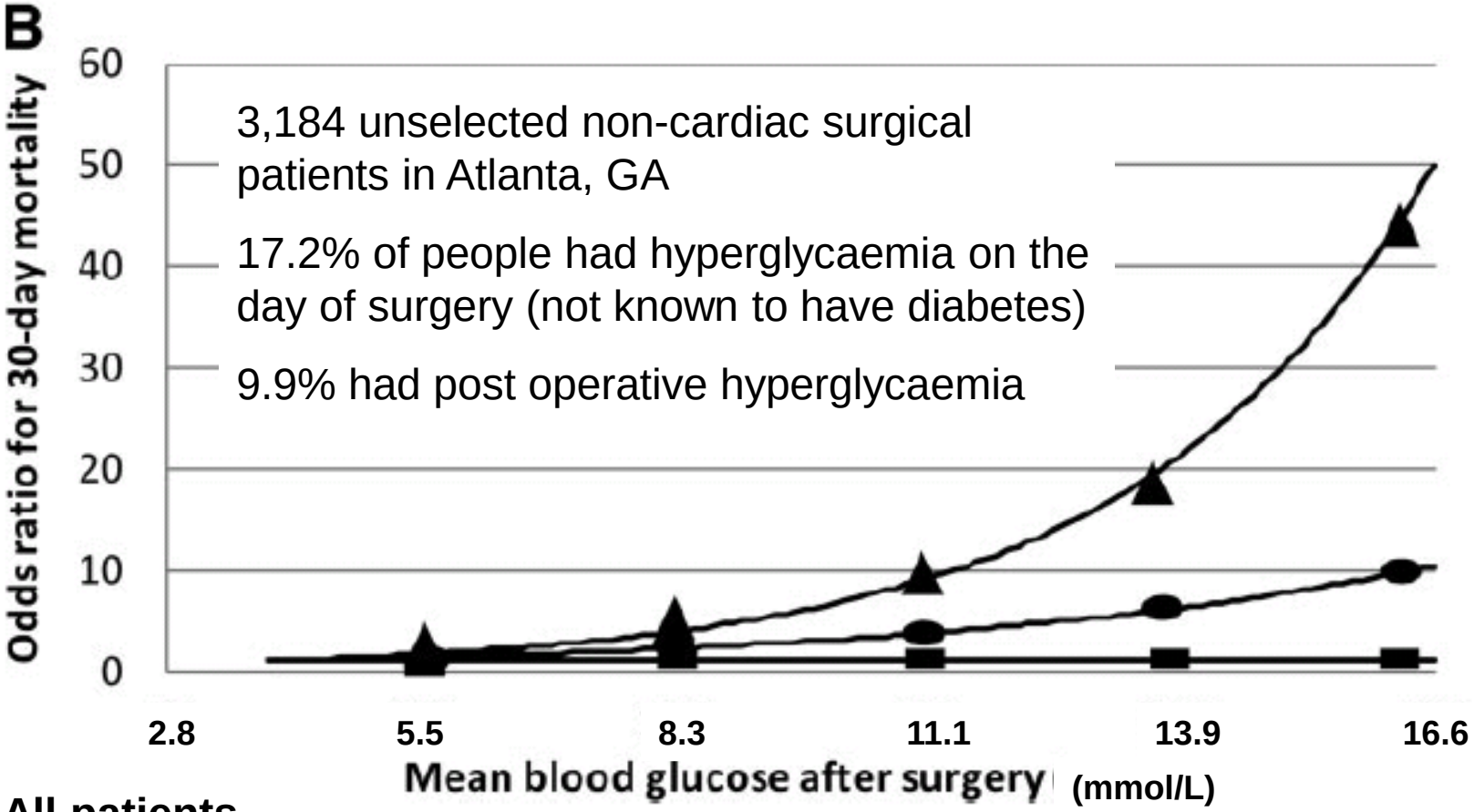
- Peri-operative hyperglycaemia is associated with poorer outcomes – however that is measured compared with people who do not have diabetes
- There are differences in outcomes between those people known to have diabetes and those who are hyperglycaemic

# Do High Glucose Levels Cause Harm?




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

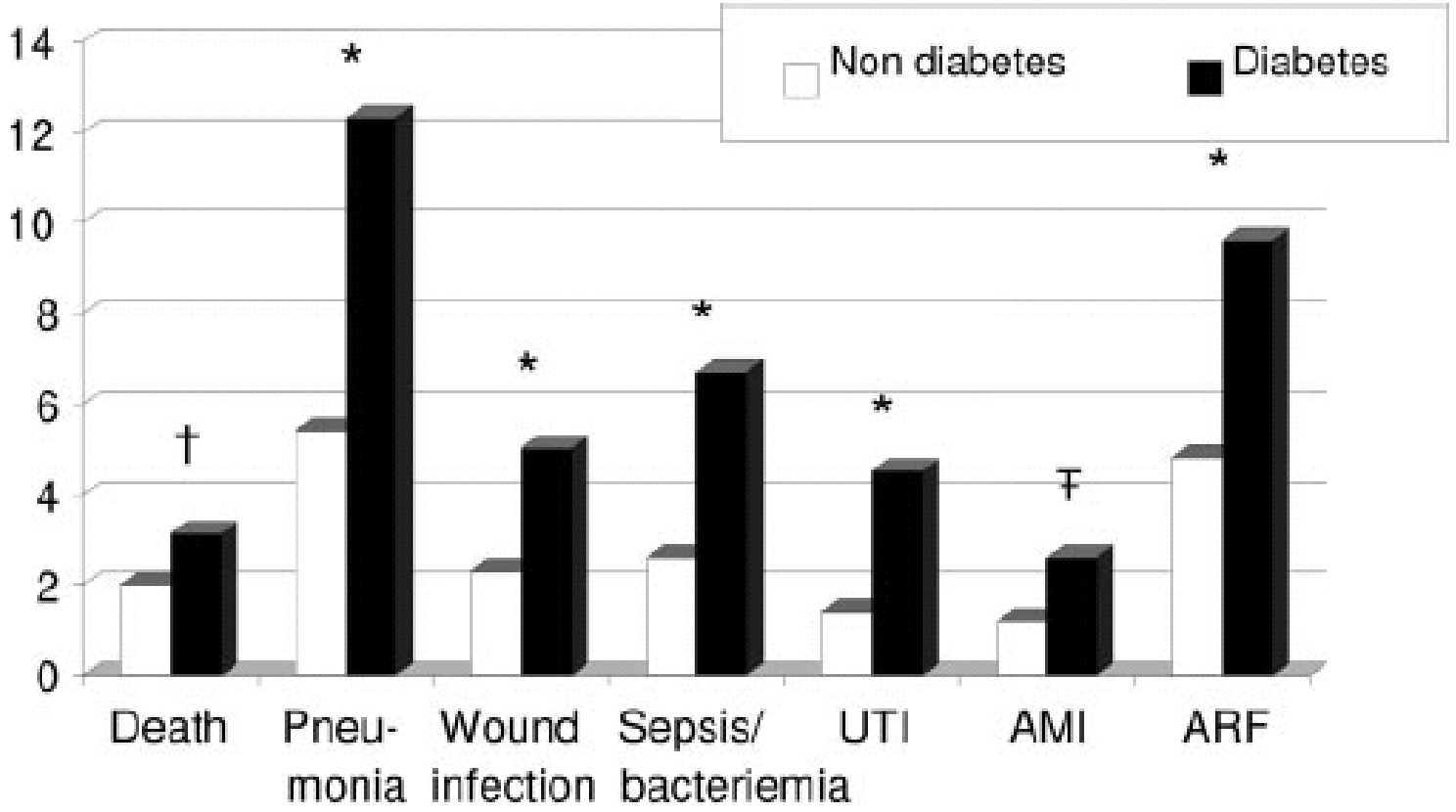
# Do High Glucose Levels Cause Harm?




- 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?




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

# More Observational Data

- 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
- 55.4 ± 15.3 years
- 65.7% women

Kwon S et al Ann Surgery 2013;257(1):8-14

# Outcomes

**TABLE 2.** Adjusted Multivariate Logistic Regression Analysis on the Effect of Perioperative Hyperglycemia (>180 mg/dL at Any Point on the Day of Surgery, Postoperative Day 1, or Postoperative Day 2) on Outcomes Presented as Odds Ratio and 95% Confidence Intervals (Within Parenthesis)

| | Composite Infections (n = 491) | Deaths (n = 48) | Reoperative Interventions (n = 257) | Anastomotic Failures (n = 43) | Myocardial Infarctions (n = 13) |
|---|---|---|---|---|---|
| Hyperglycemia | 2.0 (1.63–2.44) | 2.71 (1.72–4.28) | 1.8 (1.41–2.3) | 2.43 (1.38–4.28) | 1.15 (0.43–3.1) |
| Diabetes[§] | | | | | |
| Noninsulin-dependent | 0.51 (0.37–0.69) | 0.48 (0.25–0.93) | 0.63 (0.44–0.9) | 0.45 (0.21–0.99) | 0.77 (0.15–4.08) |
| Insulin-dependent | 0.52 (0.35–0.76) | 0.78 (0.36–1.68) | 0.54 (0.35–0.85) | 0.49 (0.18–1.32) | 1.66 (0.26–10.71) |

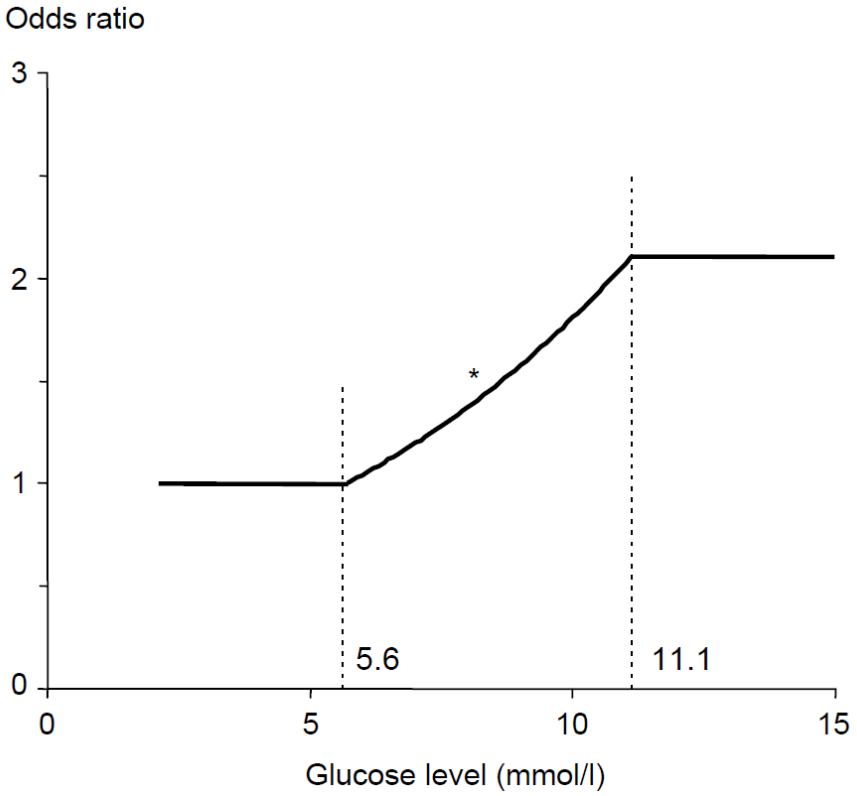
High glucose levels were associated with poor outcomes

But – having diabetes was protective (?increased vigilance)

Kwon S et al Ann Surgery 2013;257(1):8-14

# In Addition…..

- Other data has confirmed the harm of high pre-operative glucose levels in non-cardiac, non vascular surgery

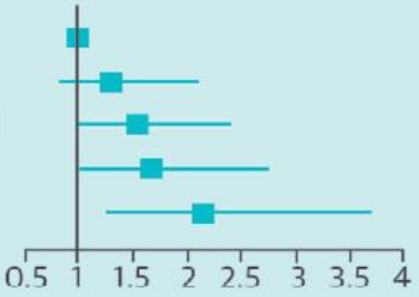



30 day mortality rates for 989 patients with diabetes – for each mmol/L increase in blood glucose, OR for mortality rose by 1.19 (CI 1.1 - 1.3)

Noordzij PG et al EJE 2007;156(1):137-142

# HbA1c and Outcome Post CABG

| Death + MACE | | | |
|---|---|---|---|
| ≤7.0 (Ref) | 29/358 | 81 [56 - 116] | 1.00 |
| 7.1 - 8.0 | 76/993 | 76 [61 - 96] | 1.34 [0.82 - 2.21] |
| 8.1 - 9.0 | 122/1,588 | 77 [64 - 92] | 1.59 [1.00 - 2.54] |
| 9.1 - 10.0 | 64/796 | 80 [63 - 103] | 1.73 [1.03 - 2.90] |
| >10.0 | 43/355 | 121 [90 - 163] | 2.25 [1.29 - 3.94] |




- 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

Nyström T et al. JACC 2015;66(5):535-543

# Is Pre-Op HbA1c a Reliable Indicator of Outcomes?

- Maybe

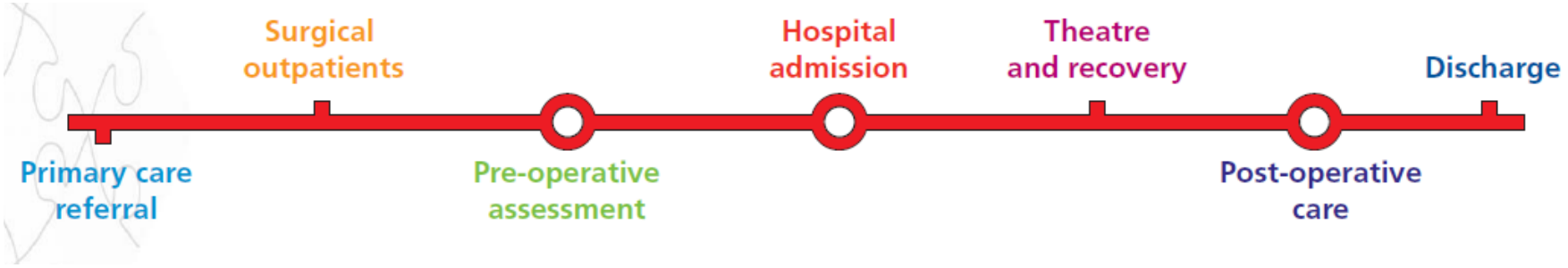
- A thorough recent systematic review concluded:

"Elevated preoperative HbA1c was not definitively associated with any postoperative morbidity or mortality in patients with diabetes mellitus. The studies included in this review were relatively heterogeneous, predominantly retrospective, and often contained small patient numbers, suggesting that good quality evidence is necessary"

Rollins KE et al Clinical Nutrition http://dx.doi.org/10.1016/j.clnu.2015.03.007

# The Patient Journey

- Primary care
- Surgical outpatients
- Pre-operative assessment clinic
- Hospital admission
- Theatre and recovery
- Post-operative care
- Discharge



# Back to the Title

- Fasted and consented but blood glucose 18mmol/L
- Prevention
  - The pre-operative manipulation of diabetes drugs prior to the procedure
- This is for people who are due to miss only 1 meal

| Insulins | Day prior to admission | Day of Surgery / whilst on a VRIII | | |
|---|---|---|---|---|
| | | Patient for a.m. surgery | Patient for p.m. surgery | If a VRIII is being used* |
| **Once daily (evening)** (e.g. Lantus® or Levemir® Tresiba® Insulatard® Humulin I®) Insuman Basal®) | Reduce dose by 20% | Check blood glucose on admission | Check blood glucose on admission | Continue at 80% of the usual dose |
| **Once daily (morning)** (Lantus® or Levemir® Tresiba® Insulatard® Humulin I®) Insuman Basal®) | Reduce dose by 20% | Reduce dose by 20% Check blood glucose on admission | Reduce dose by 20% Check blood glucose on admission | Continue at 80% of the usual dose |
| **Twice daily** (e.g. Novomix 30®, Humulin M3® Humalog Mix 25®, Humalog Mix 50®, Insuman® Comb 25, Insuman® Comb 50 twice daily Levemir® or Lantus®) | No dose change | Halve the usual morning dose. Check blood glucose on admission Leave the evening meal dose unchanged | Halve the usual morning dose. Check blood glucose on admission Leave the evening meal dose unchanged | Stop until eating and drinking normally |
| **Twice daily - separate injections of short acting** (e.g. animal neutral, NovoRapid® Humulin S®, Apidra®) **and intermediate acting** (e.g. animal isophane Insulatard®, Humulin I® Insuman®) | No dose change | 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 | 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 | Stop until eating and drinking normally |
| **3, 4 or 5 injections daily** (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) | No dose change | **Basal bolus regimens:** omit the morning and lunchtime short acting insulins. Keep the basal unchanged.* **Premixed am insulin:** halve the morning dose and omit lunchtime dose. Check blood glucose on admission | Take usual morning insulin dose(s). Omit lunchtime dose. Check blood glucose on admission | Stop until eating and drinking normally |

| Tablets | Day prior to admission | Day of Surgery / whilst on a VRIII | | |
|---|---|---|---|---|
| | | **Patient for a.m. surgery** | **Patient for p.m. surgery** | **If a VRIII is being used*** |
| **Acarbose** | Take as normal | Omit morning dose if NBM | Give morning dose if eating | Stop once VRIII commenced, do not recommence until eating and drinking normally |
| **Meglitinide** (repaglinide or nateglinide) | Take as normal | Omit morning dose if NBM | Give morning dose if eating | Stop once VRIII commenced, do not recommence until eating and drinking normally |
| **Metformin**<br><br>(eGFR is greater than 60 ml/min/1.73m$^2$ and procedure not requiring use of contrast media**) | Take as normal | If taken once or twice a day – take as normal<br><br>If taken three times per day, omit lunchtime dose | If taken once or twice a day – take as normal<br><br>If taken three times per day, omit lunchtime dose | Stop once VRIII commenced, do not recommence until eating and drinking normally |
| **Sulphonylurea**<br>(e.g. glibenclamide, gliclazide, glipizide, glimeperide) | Take as normal | If taken once daily in the morning – omit the dose that day<br><br>If taken twice daily – omit the morning dose that day | If taken once daily in the morning – omit the dose that day<br><br>If taken twice daily – omit both doses that day | Stop once VRIII commenced, do not recommence until eating and drinking normally |
| **Pioglitazone** | Take as normal | Take as normal | Take as normal | Stop once VRIII commenced, do not recommence until eating and drinking normally |
| **DPP IV inhibitor**<br><br>(e.g. sitagliptin, vildagliptin, saxagliptin, alogliptin, linagliptin) | Take as normal | Take as normal | Take as normal | Stop once VRIII commenced, do not recommence until eating and drinking normally |
| **GLP-1 analogue** (e.g. exenatide, liraglutide, lixisenatide, dulaglutide) | Take as normal | Take as normal | Take as normal | Take as normal |
| **SGLT-2 inhibitors**<br><br>(e.g. dapagliflozin, canagliflozin, empagliflozin) | Take as normal | Omit on day of surgery | Omit on day of surgery | Stop once VRIII commenced, do not recommence until eating and drinking normally |

# More Than 1 Missed Meal / Urgent

- Variable rate intravenous insulin infusion (VRIII)
- Or if the surgery is urgent and glycaemic control cannot be optimised prior to surgery – aim for blood glucose values between 6.0 and 10.0 mmol/L (although 6.0 to 12.0 mmol/L is acceptable)

# Back to the Title

- Fasted and consented but blood glucose 18mmol/L
- I'll assume this is pre-operative

# That Depends on the Patient

- For people with type 1
  - Give subcutaneous rapid acting insulin. Assume that 1 unit will lower glucose by 3mmol/L. Recheck glucose 1 hour later
  - If it is not falling and surgery can be delayed, do so
  - If surgery cannot be delayed then commence a VRIII

# That Depends on the Patient

- For people with type 2
  - Give subcutaneous rapid acting insulin at a dose of 0.1units/kg. Recheck glucose 1 hour later
  - If it is not falling and surgery can be delayed, do so
  - If surgery cannot be delayed then commence a VRIII

# Back to the Title

- Fasted and consented but blood glucose 18mmol/L
- What about post operative?

# That Depends on the Patient

- For people with type 1
  - Give subcutaneous rapid acting insulin. Assume that 1 unit will lower glucose by 3mmol/L. But, if the patient is awake, then ask them what they would normally do in this situation
  - Recheck glucose 1 hour later, and repeat once more if the glucose is >12.0mmol/L
  - If it is not falling then consider commencing a VRIII

# That Depends on the Patient

- For people with type 2
  - Give subcutaneous rapid acting insulin at a dose of 0.1units/kg. Recheck glucose 2 hour later, and if it is still >12.0mmol/L consider doubling the insulin dose and/or the response to the initial dose
  - If it is not falling then consider commencing a VRIII

# A Glimmer of Hope?

**Health Technology Assessment Programme**

NHS
*National Institute for Health Research*

**HTA no 16/25**

**Poorly controlled diabetes and outcomes of elective surgery**

Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust


# Fasted and Consented but Blood Glucose 18mmol/L

## or How to Manage Diabetes in the Peri-Operative Period

www.norfolkdiabetes.com

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