Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Glycaemic Control in the Patient with Diabetes Undergoing Revascularisation

or

Peri-operative Glucose Control - Is it Important?

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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

Variation in Inpatient Activity: Diabetes. http://www.yhpho.org.uk/resource/view.aspx?RID=105866

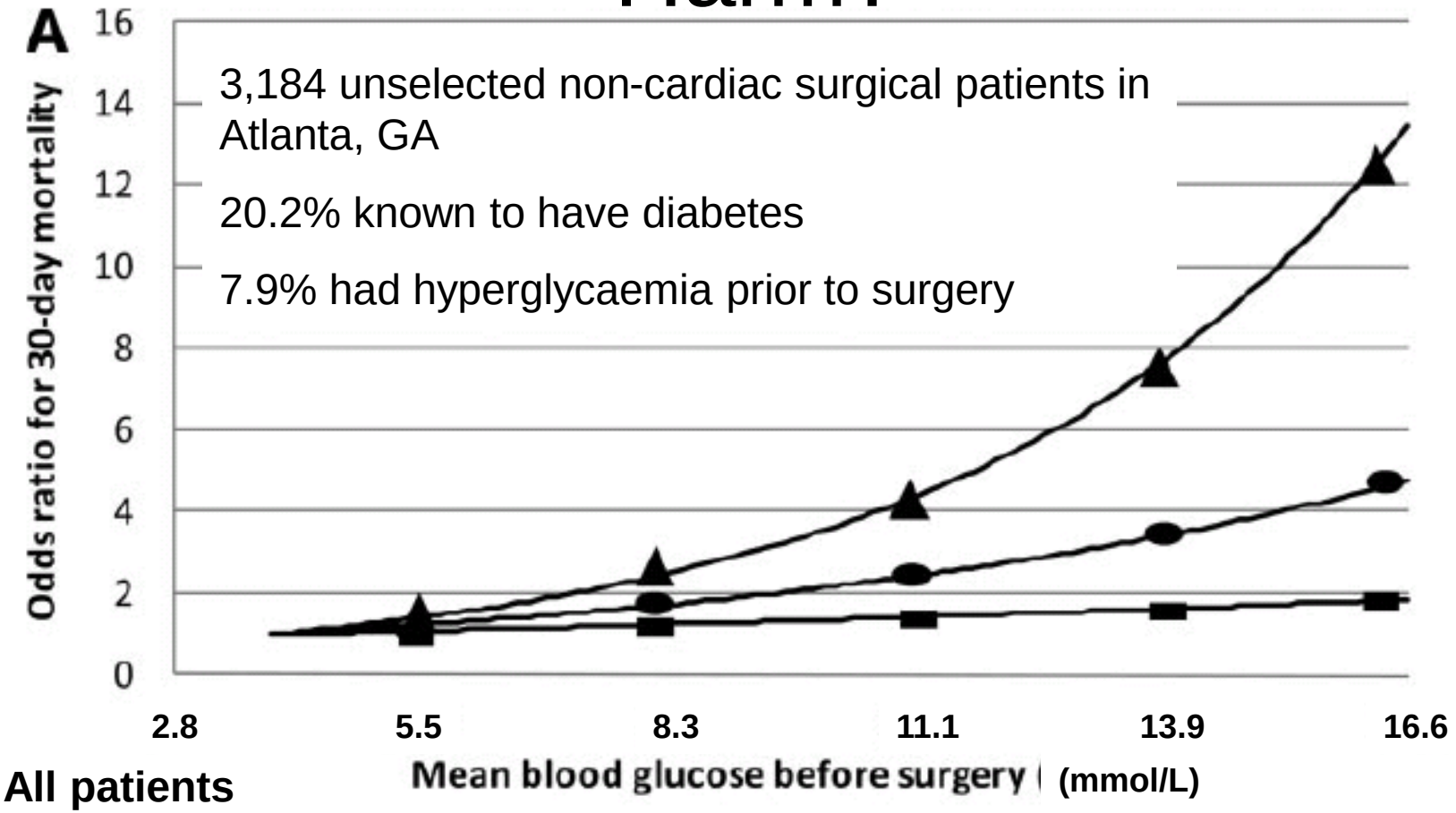
Last accessed 19th April 2017

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

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
Gustafsson UO et al Brit J Surg 2009;96:1358-1364
Halkos ME et al Ann of Thorac Surg 2008;86:1431-1437
Kreutziger J et al J Trauma 2009;67(4):704-8
Vilar-Compte et al Am J Infect Control 2008;36(3):192-198
Park C et al Transplantation 2009;87(7):1031-1036
Ambiru S et al J Hosp Infect 2008;68(3):230-233
Chaung SC et al J Formos Med Ass 2004;103(8):607-612
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
Domek N et al J Foot Ank Surg 2016;55(5):939-943

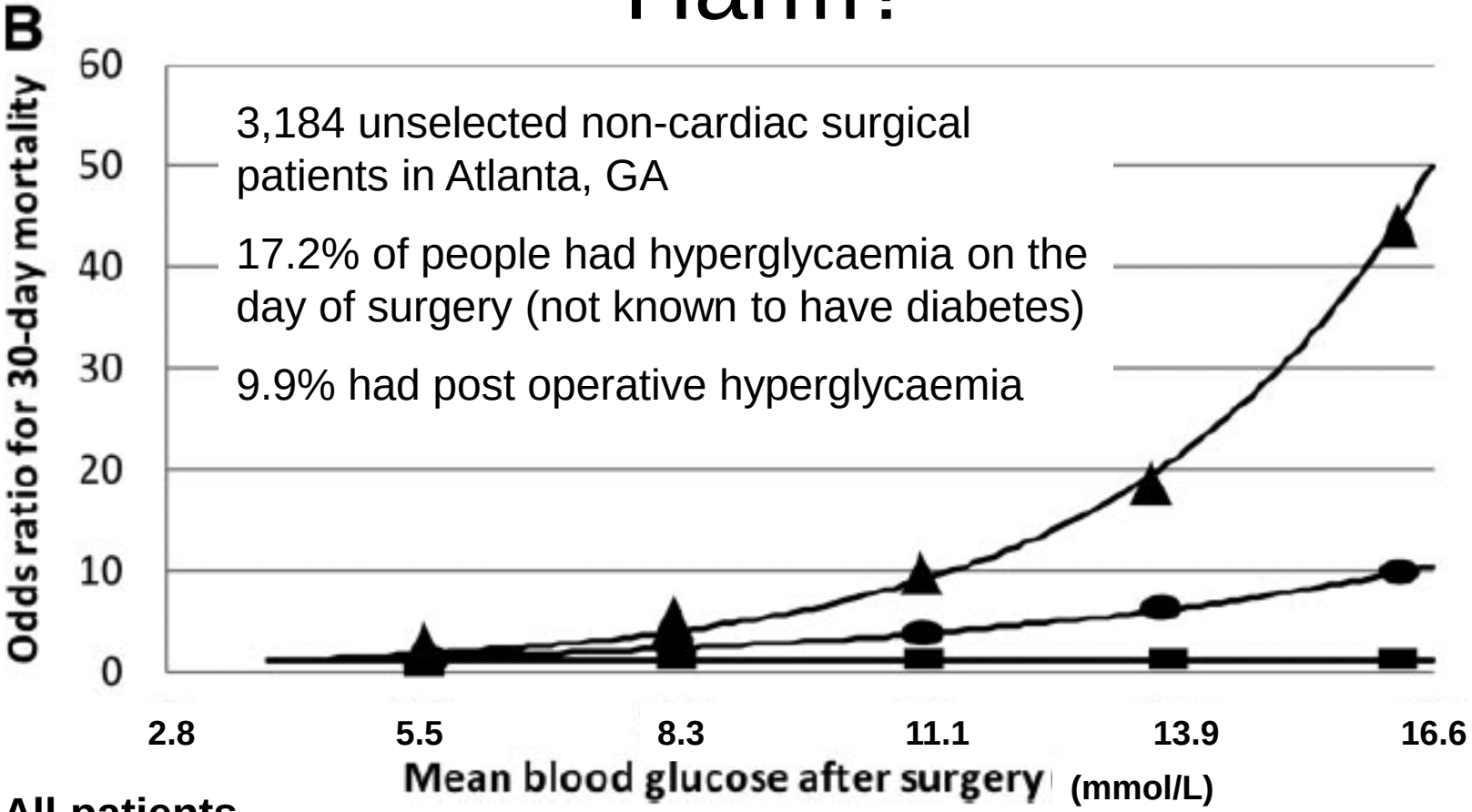
Do High Glucose Levels Cause Harm?



- 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

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

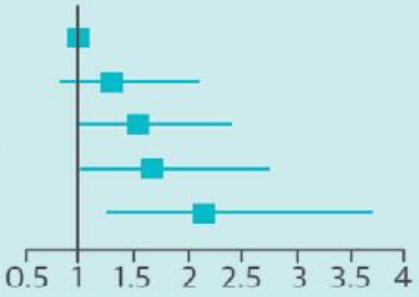
But – having diabetes was protective (?increased vigilance)

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

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

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

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

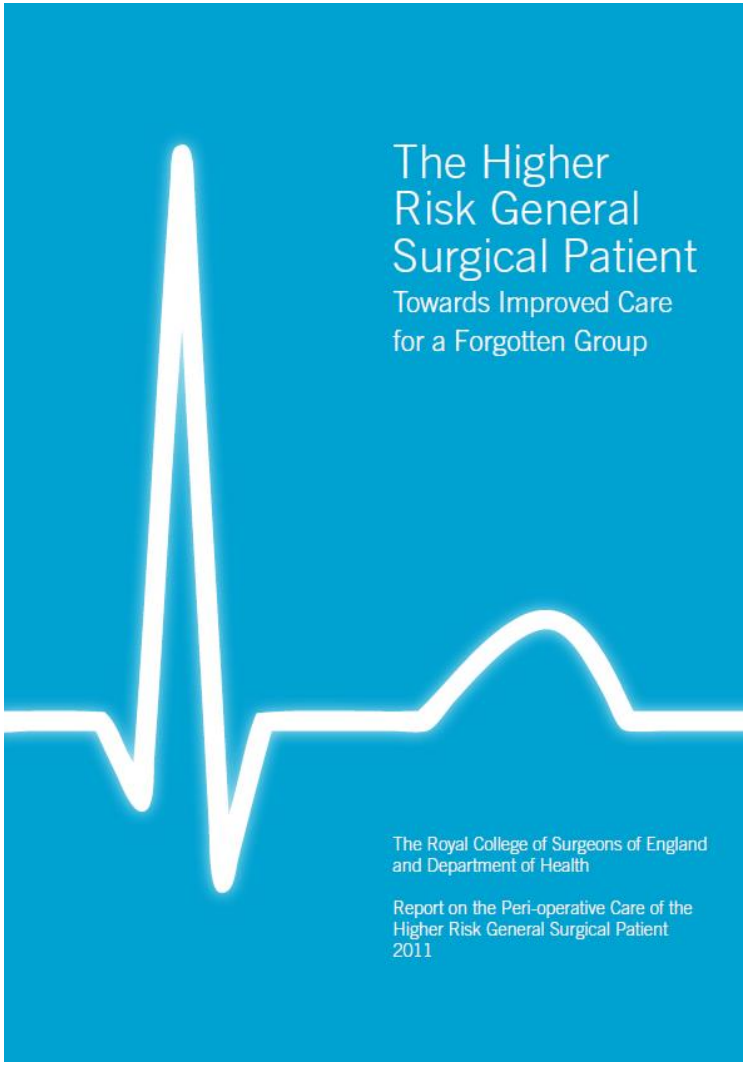
Blaha J et al J Clin Endo Metabol 2015;100(8):3081-3089

What About ITU??

Author	Year	Patients	No. pts	% Diabetes	Target blood IGC mg/dl	Glucose CGC mg/dl	Benefit	Outcome
Adults								
Leuven I	2001	Surgical[a]	1548	13	80–110	180–200	Yes	Reduced mortality, AKI, infections, LOS, increased hypoglycemia
Leuven II	2006	MICU	1200	17	80–110	180–200	?	NOB, reduced AKI, LOS, increased hypoglycemia
GLUCON-TROL	2007	Mixed	1078	18	80–110	140–180	No	NOB, increased hypoglycemia
VISEP	2008	Mixed[c]	537	30	80–110	180–200	No	NOB, increased hypoglycemia
de la Rosa	2008	Mixed	504	12	80–110	180–200	No	NOB, increased hypoglycemia
Arabi	2008	Mixed	240	40	80–110	180–200	No	NOB, increased hypoglycemia
Bilotta	2008	TBI	97	–	80–120	<220	No	NOB, reduced LOS, increased hypoglycemia
Bilotta	2009	N/surgery	483	10	80–110	<215	No	NOB, reduced LOS, reduced UTI, increased hypoglycemia
NICE-SUGAR	2009	Mixed	6022	20	80–110	<180	No	HARM, increased mortality, increased hypoglycemia
COIITSS	2010	Mixed	509	–	80–110	180–200	No	NOB, increased hypoglycemia
Coester	2010	TBI	88	–	80–110	<220	No	NOB, increased hypoglycemia
INSULIN-FARCT	2012	Stroke	180	–	IIT	SIT	No	HARM, larger infarct growth
BIOMArCS-2	2013	ACS	280	10	85–110	<288	No	HARM, composite of death and second AMI
CGAO-REA	2014	Mixed	2684	23	80–110	<180	No	NOB, increased hypoglycemia
Children								
Vlasselaers	2009	Mixed	700[b]	3	Infants (50–80) Children (70–100)	214 214	Yes	Reduced LOS, infections, mortality, increased hypo-glycemia
SPECS	2012	C/surgery	980	–	80–110	No target	No	NOB
CHiP	2014	Mixed	1369	–	72–126	<216	No	NOB, increased hypoglycemia

Marik PE Intensive Care Medicine 2016;42(9):1475-1477

Something Some of You May Have Seen

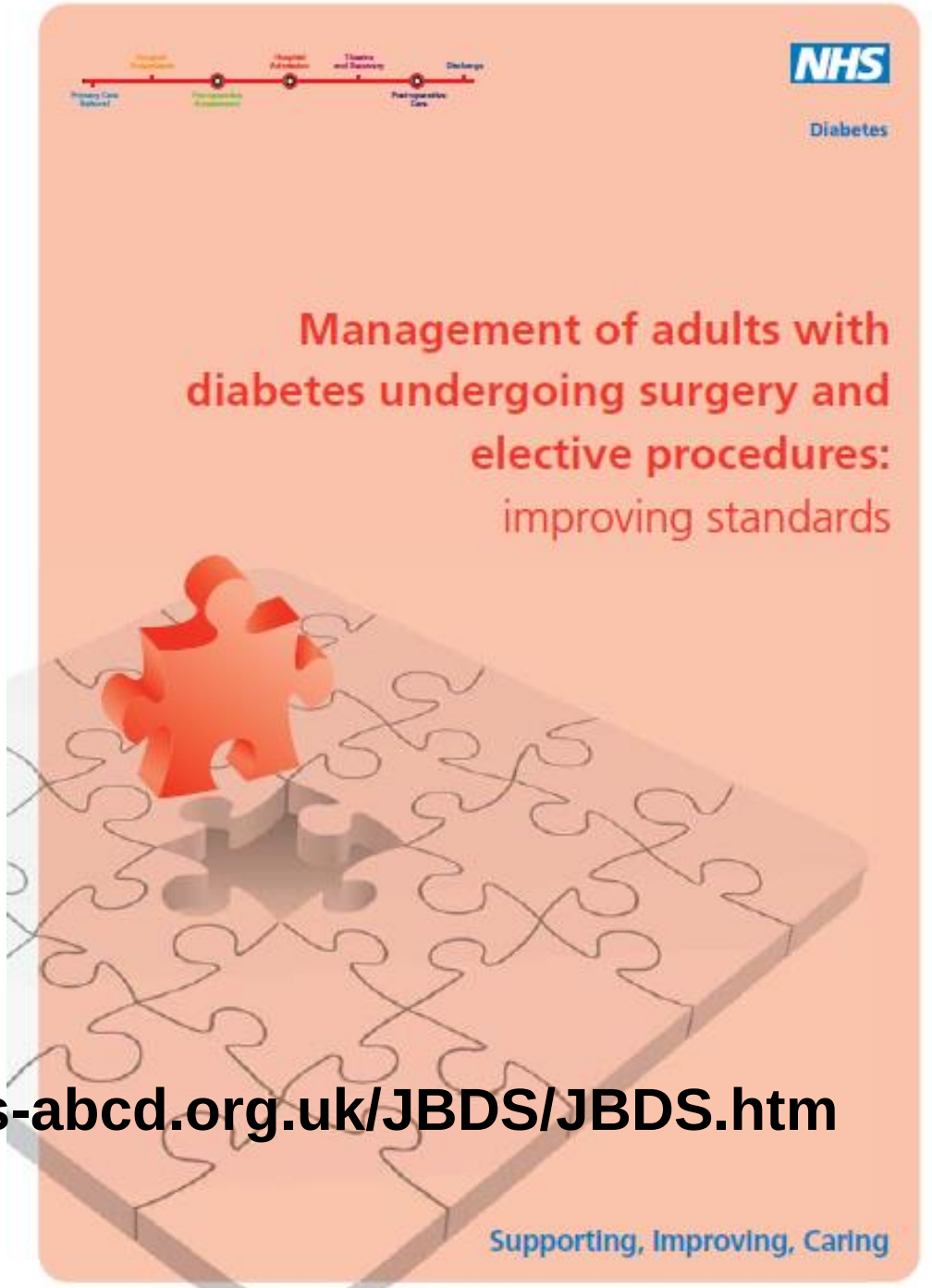


- Disappointingly, the word ‘diabetes’ appears only once, ‘hyperglycaemia’ and ‘glucose’ do not appear at all in this document

https://www.rcseng.ac.uk/library-and-publications/college-publications/docs/the-higher-risk-general-surgical-patient/

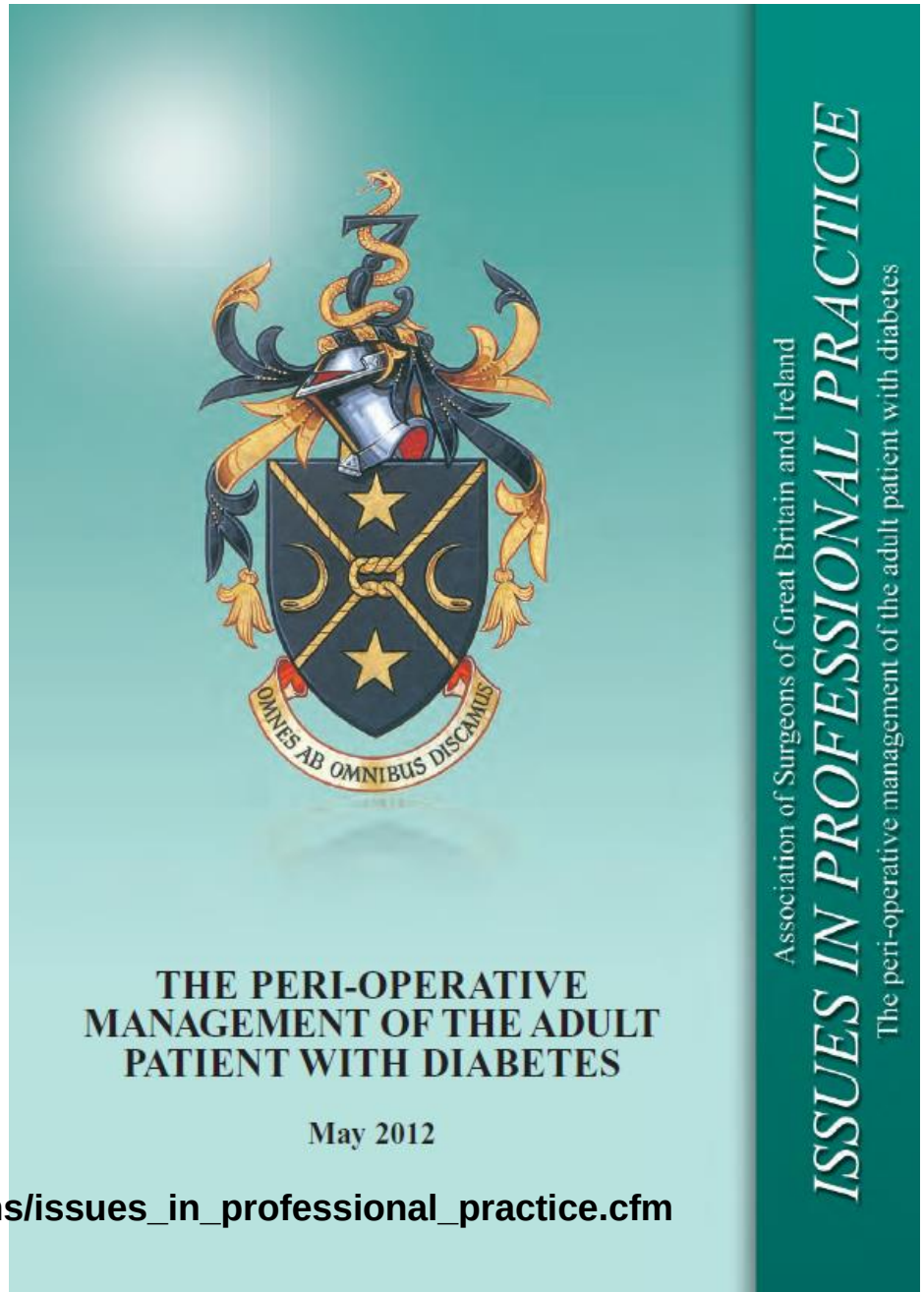
Last accessed 17th April 2017

In 2011 Along Came This…..



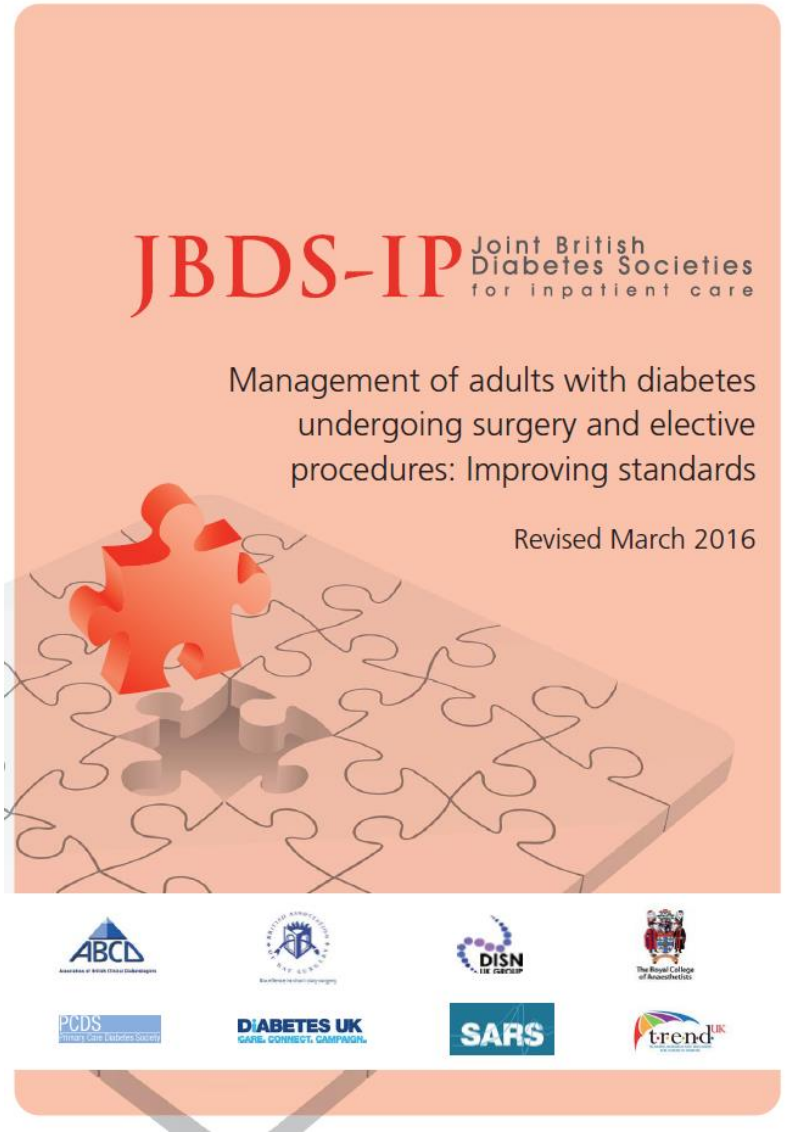
http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm

And This…..



http://www.asgbi.org.uk/en/publications/issues_in_professional_practice.cfm

It Has Now Been Updated



It's Part of the Anaesthetists Bible - GPAS

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

Guidelines

Peri-operative management of the surgical patient with diabetes 2015

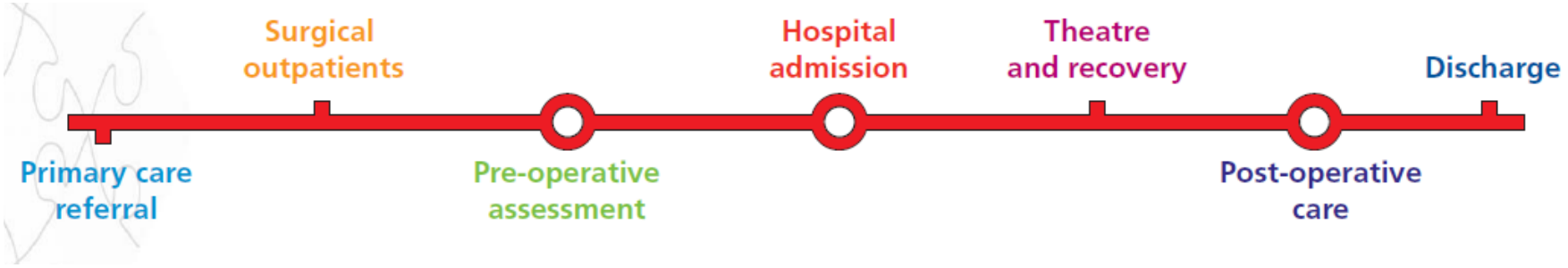
Association of Anaesthetists of Great Britain and Ireland

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

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

National Guidelines

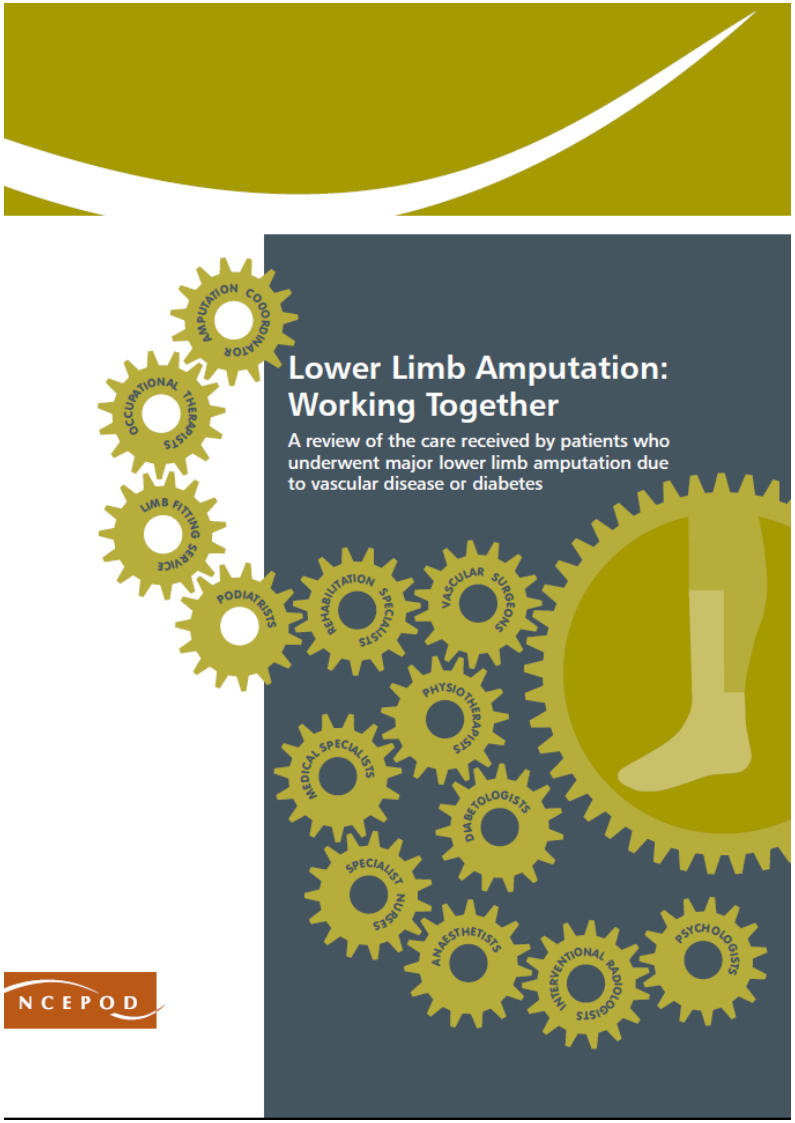
- Document divided into sections:
  - Primary care
  - Surgical outpatients
  - Pre-operative assessment clinic
  - Hospital admission
  - Theatre and recovery
  - Post-operative care
  - Discharge



Insulins	Day prior to admission	Day of Surgery / whilst on a VRIII		
		Patient for AM surgery	Patient for PM surgery	If a VRIII is being used*
Once daily (evening) (e.g. Lantus® or Levemir® Tresiba® Insulatard® Humulin I®) Insuman®)	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®)	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 a.m. 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 AM surgery	Patient for PM 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 (e.g 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 (eGFR is greater than 60ml/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 If taken three times per day, omit lunchtime dose	If taken once or twice a day – take as normal If taken three times per day, omit lunchtime dose	Stop once VRIII commenced, do not recommence until eating and drinking normally
Sulphonylurea (e.g glibenclamide, gliclazide, glipizide, etc.)	Take as normal	Once daily am omit Twice daily omit am	Once daily am omit Twice daily omit am and pm	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 (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 (e.g. dapagliflozin, canagliflozin)	Take as normal	Omit on day of surgery	Omit on day of surgery	Omit until eating and drinking normally

NCEPOD



- 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

http://www.ncepod.org.uk/2014report2/downloads/WorkingTogetherFullReport.pdf

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www.norfolkdiabetes.com

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