28 MAGGIO 2016 CENTO
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LA COMPLESSITÀ ASSISTENZIALE DELLA PERSONA CON DIABETE IN OSPEDALE E SUL TERRITORIO: UN UPDATE SULLE PIÙ RECENTI ACQUISIZIONI DI GOVERNO CLINICO E GESTIONE DELLA TERAPIA

con il Patrocinio di: AMD EMILIA ROMAGNA e SIMDO

Il trattamento del paziente diabetico con programma di interventi chirurgici, di indagini radiologiche o di procedure interventistiche

Giovanni Sorrenti
Diabetologia & Metabolismo
U.O. di Medicina Interna della Pianura
Ospedale di Bentivoglio – Azienda USL di Bologna
(Direttore: dr. G. Bragagni)

SID
Società Italiana di Diabetologia

La gestione della persona con diabete ricoverata per altra patologia

Prima edizione: aprile 2016

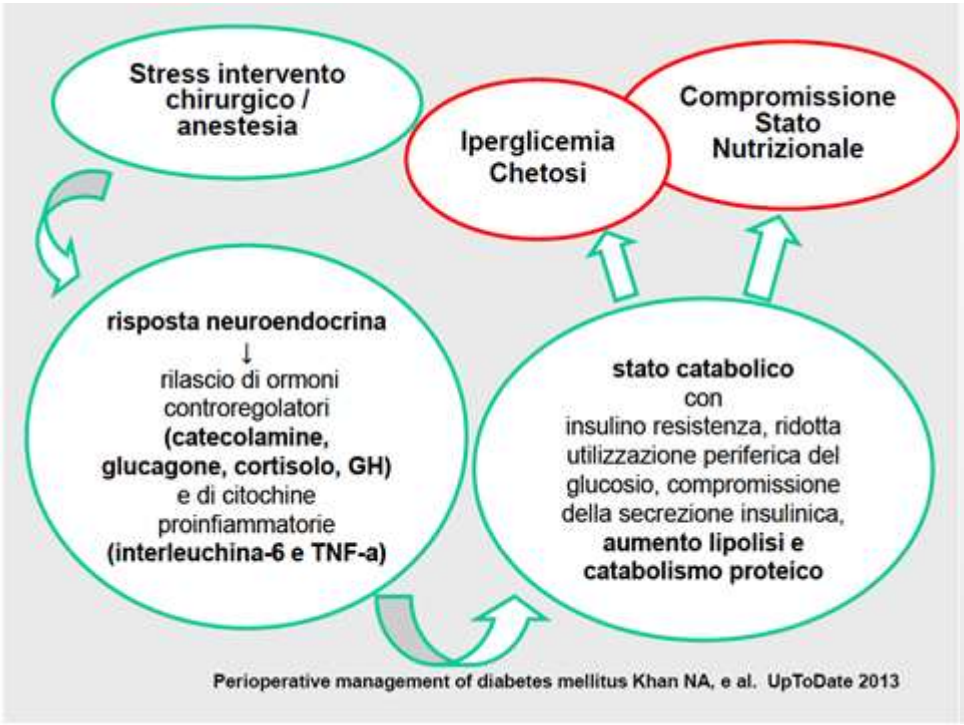
a cura di Daniela Bruttomesso e Laura Sciacca

Sommario

Presentazione

Le complicanze classiche del diabete sono a carico di occhio, rene, nervi e sistema cardiovascolare ma va sottolineato che ogni cellula, tessuto, organo o apparato soffrono in presenza di iperglicemia e delle altre alterazioni proprie del *milieu* diabetico (dislipidemia, ipertensione, stress ossidativo, infiammazione, disfunzione endoteliale, ecc.). Questo si traduce nel fatto che quasi tutte le patologie, acute e croniche, compaiono più spesso nelle persone con diabete e che la loro espressione clinica è talora più severa. Non è quindi sorprendente che in tutti i reparti ospedalieri siano spesso ricoverate persone con diabete non solo per eventi cardiovascolari, insufficienza renale, emorragia retinica, plessopatia dolorosa o piede diabetico ma per infezioni, traumi, interventi chirurgici, neoplasie, ecc.

La presenza del diabete ha un impatto sull'esito del processo patogeno, quale esso sia, e per questo motivo il buon controllo metabolico dovrebbe essere perseguito in occasione di ogni ricovero ospedaliero. Questo dogma, tuttavia, è spesso misconosciuto o trascurato. In questi casi, molta attenzione viene dedicata alla patologia che ha causato il ricovero mentre la cura del diabete viene collocata in secondo piano, per poi tornare di attualità quando ci si rende conto che la glicemia è molto alta, che certi farmaci anti-iperglicemizzanti sono diventati controindicati o che la terapia insulinica, spesso iniziata durante il ricovero, deve essere proseguita a domicilio senza che il paziente sia addestrato a gestirla.



Il diabete determina un aumento della morbilità ospedaliera ed un allungamento della degenza con conseguente aumento dei costi (1-2). Questo è particolarmente vero nei reparti chirurgici dove si è stimato un aumento della degenza media del 45% nei pazienti diabetici rispetto ai pazienti diabetici ricoverati nelle corsie di medicina (3) con un aumento della mortalità (4). Le ragioni sono multifattoriali e comprendono l'aumentato rischio ipo e iperglicemico, la presenza di comorbilità multiple, la presenza di complicanze croniche del diabete, la complessità della terapia compresi i rischi della terapia insulinica, le infezioni la scarsa attenzione che si riserva al problema (5-7).

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6. Sampson MJ, Brennan C, Dhatariya K, Jones C, Walden E. A national survey of in-patient diabetes services in the United Kingdom. Diabetic Med 2007; 24: 643-649.
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"goals" del perioperatorio nel diabetico

- *Mantenimento dell'equilibrio idro-elettrolitico*
- *Prevenzione della chetoacidosi*
- *Evitare importanti squilibri glicemici:*
  - ***marcata iperglicemia***
  - ***ipoglicemia***

Perioperative management of diabetes mellitus Khan NA, s al. UpToDate 2013

A.S.P.E.N. Clinical Guidelines - 2013
Nutrition Support of Adult Patients With Hyperglycemia

Question: What is the desired blood glucose goal range in adult hospitalized patients receiving nutrition support ?

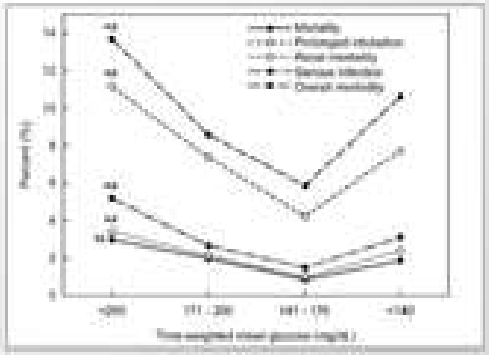
Recommendation: We recommend a target blood glucose goal range of **140–180 mg/dL (7.8–10 mmol/L).**

Grade: **Strong**

Rationale: Hyperglycemia is associated with increased mortality in hospitalized patients..... Earlier studies showed ..... a reduction in mortality..... blood glucose ..... below 110 mg/dL (6.1 mmol/L)

.....However, more recent large clinical trials .....found a **higher mortality** in patients treated with intensive treatment compared with those treated to a target blood glucose range of 140–180 mg/dL (7.8–10 mmol/L)..... **Hypoglycemia associated with aggressive treatment** in the more recent studies is one likely explanation.....

Hyperglycemia and Perioperative Glucose Management
Duncan AE - Curr Pharm Des. 2012



Maggiori complicanze

	No diabetes (%)	Diabetes (%)	OR (95% CI)†
Postoperative complications			
Septicemia	4.2	10.0	2.76 (2.50–3.04)
Pneumonia	2.7	4.6	1.88 (1.65–2.14)
Stroke	2.8	4.4	1.70 (1.49–1.94)
Acute renal failure	0.7	2.4	3.59 (2.88–4.48)
Deep wound infection	0.8	1.0	1.33 (1.04–1.70)
Acute myocardial infarction	0.2	0.7	3.65 (2.43–5.49)
Any of the above	9.6	19.2	2.42 (2.26–2.60)
Any noninfectious complications	6.9	14.0	2.37 (2.18–2.56)
Any infectious complications	3.6	7.2	2.23 (2.00–2.49)
30-day postoperative mortality	0.8	1.3	1.84 (1.46–2.32)
Prolonged length of hospital stay	13.2	25.2	2.30 (2.16–2.44)
ICU stay	29.0	38.8	1.67 (1.59–1.76)
Increased medical expenditure	18.0	22.0	1.32 (1.25–1.40)

*Preoperative diabetes was defined as the patient having at least one hospital admission and at least one visit for outpatient medical services related to diabetes. †Adjusted for age, sex, teaching hospital, low-income status, urbanization, coexisting diseases, type of surgery, and type of anesthesia.

Chun-Chieh Yeh et al Adverse Outcomes After Noncardiac Surgery in Patients With Diabetes A nationwide population - based retrospective cohort study ***Diabetes Care October 2013 ; vol 36, 10: 3216-3221***

PROBLEMATICHE DA AFFRONTARE

Le raccomandazioni seguono il percorso del paziente dalla valutazione pre-ricovero, all'accettazione in reparto, alla gestione perioperatoria, alla dimissione.

FIGURE 1 Pathway of care for elective surgery.

Diabet. Med. 29, 420–433 (2012)

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[11] for the Joint British Diabetes Societies

[1]Norfolk and Norwich University Hospitals, Norwich, [2]West Suffolk Hospital, Bury St Edmonds, [3]Northampton General Hospital, Northampton, [4]Queen Elizabeth Hospital, Kings Lynn, [5]National Patient Safety Agency, London, [6]Plymouth Hospital, Plymouth, [7]Bolton Primary Care Trust, Bolton, [8]Charing Cross Hospital, London, [9]Queens Medical Centre, Nottingham, [10]John Radcliffe Hospital, Oxford and [11]Ipswich Hospital and NHS Diabetes, National Clinical Lead for Inpatient Diabetes, Ipswich, UK

Accepted 11 January 2012

Abstract

These Joint British Diabetes Societies guidelines, commissioned by NHS Diabetes, for the perioperative management of the adult patient undergoing surgery are available in full in the Supporting Information.

This document goes through the seven stages of the patient journey when having surgery. These are: primary care referral; surgical outpatients; preoperative assessment; hospital admission; surgery; post-operative care; discharge. Each stage is given its own considerations, outlining the roles and responsibilities of each group of healthcare professionals. The evidence base for the recommendations made at each stage, discussion of controversial areas and references are provided in the report.

This document has two key recommendations. Firstly, that the management of the elective adult surgery patients should be with modification to their usual diabetes treatment if the fasting is minimized because the routine use of a variable rate intravenous insulin infusion is not recommended. Secondly, that poor preoperative glycaemic control leads to post-outcomes and thus, where appropriate, needs to be addressed prior to referral for surgery.

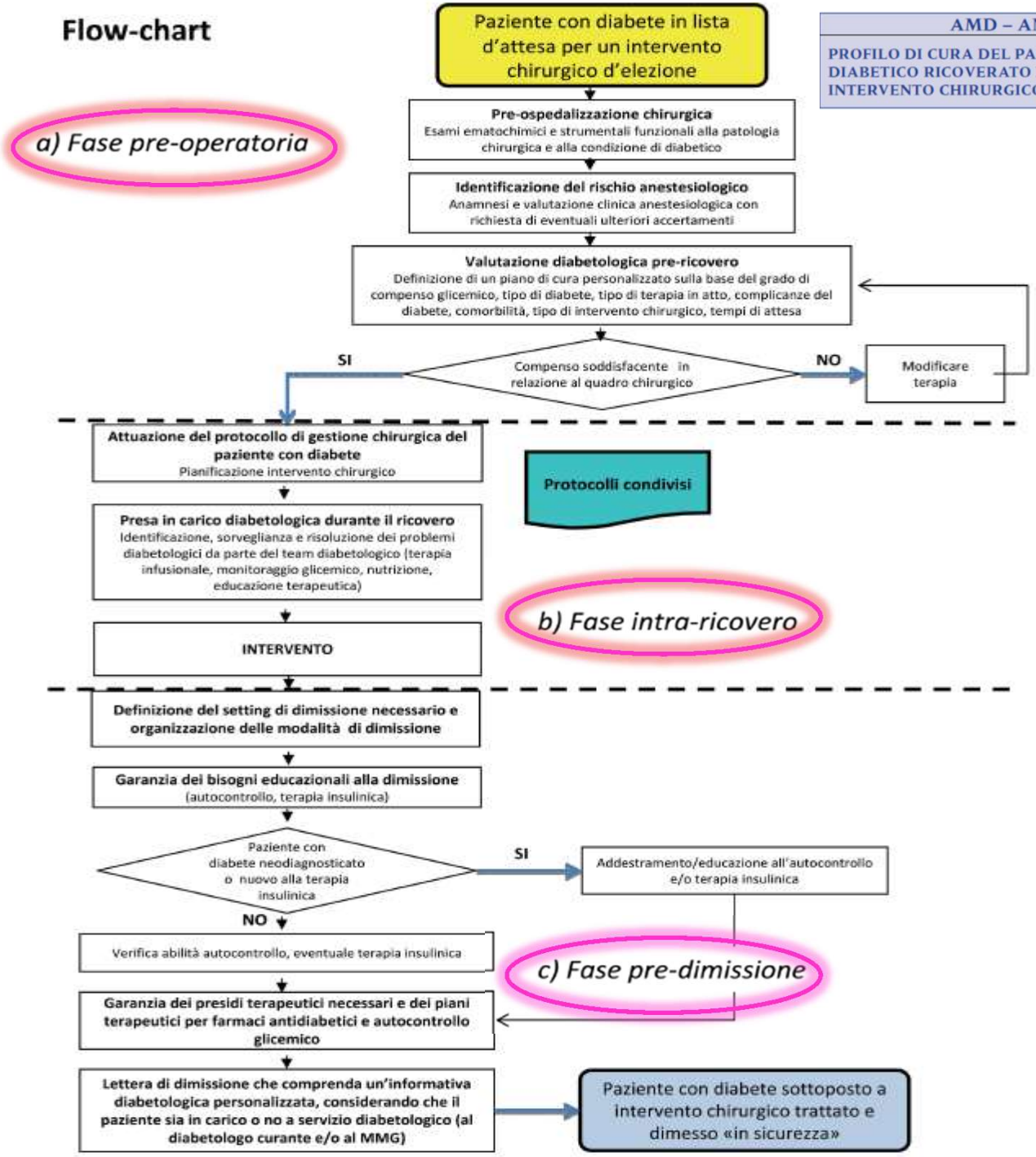
Diabet. Med. 29, 420–433 (2012)

Keywords diabetes, guidelines, perioperative management, surgery, variable rate intravenous insulin infusion

Tabella 3 ♦ **Classificazione degli interventi chirurgici**

MINORI	Richiedono meno di 2 ore ed è prevista la ripresa dell'alimentazione nel postoperatorio (endoscopie, angiografie, facoemulsione di cataratta, interventi ortopedici minori...)
MAGGIORI	Durata superiore alle 2 ore e in cui non è prevista la ripresa dell'alimentazione nel postoperatorio (by-pass vascolari e coronarici, interventi neurochirurgici, interventi su organi dell'apparato gastrointestinale, toracochirurgia, trapianti, protesi ortopediche...)

Flow-chart



AMD – ANMCO – ANMDO – SIC – SIMEU – FIMEUC

PROFILO DI CURA DEL PAZIENTE DIABETICO RICOVERATO PER UN INTERVENTO CHIRURGICO D'ELEZIONE

REV 04 - 19/02/2014

I percorsi assistenziali ospedale-territorio

Profilo di cura del paziente diabetico ricoverato per un intervento chirurgico d'elezione
Profilo di cura del paziente con iperglicemia in DEU
Profilo di cura del paziente con iperglicemia ricoverato in Cardiologia

PROBLEMI DEL PAZIENTE DIABETICO IN CORSO DI ANESTESIA E CHIRURGIA

A. **CHIRURGIA DI ELEZIONE**

1.problemi del periodo preoperatorio:

1.1 la valutazione della malattia diabetica;
1.2 la valutazione delle complicanze;
1.3 il riequilibrio metabolico ed idro-elettrolitico;
1.4 la (ri)definizione di eventuali terapie mediche accessorie;
1.5 la preparazione farmacologica all'intervento:
1.5.1 la terapia insulinica;
1.5.2 la premedicazione anestetica;
1.5.2.1 la profilassi della trombosi venosa profonda;
1.5.2.2 la prevenzione della sindrome da inalazione.

2. **problemi del periodo intraoperatorio**:
2.1 la scelta della tecnica anestesiologica;
2.2 la somministrazione di insulina;
2.3 in monitoraggio in generale e quello metabolico, in particolare.

3. **problemi del periodo postoperatorio immediato**:
3.1 il monitoraggio postoperatorio in generale;

Anaesthetic management of diabetes

Inas Ahmed

Swamy Mruthunjaya

ANAESTHESIA AND INTENSIVE CARE MEDICINE 15:10

Why diabetes challenges anaesthesia and surgery

- Multiple associated co-morbidities and multi-systems affected.
- Obesity.
- Cardiovascular risk factors and the increased possibility of developing silent myocardial ischaemia.
- Stiff joint syndrome may cause difficult airways.
- Autonomic neuropathy may result in gastroparesis increasing the risk of aspiration.
- Nephropathy may limit the use of intraoperative and postoperative non-steroidal anti-inflammatory drugs.
- Glycaemic control needs to be maintained both intra-operatively and postoperatively.
- These patients are also more prone to wound infections.
- Poor preoperative glycaemic control was associated with increased postoperative complications, including increased need for blood products and longer critical care and hospital stay.

Anaesthetic management of diabetes

Inas Ahmed

Swamy Mruthunjaya

Inas Ahmed *FRCA is a Specialty Registrar in Anaesthesia in the North-west Deanery, UK. Conflict of interest: none declared.*

Swamy Mruthunjaya *FCARCSI is a Locum Consultant Anaesthetist in Manchester Royal Infirmary, UK. Conflict of interest: none declared.*

ANAESTHESIA AND INTENSIVE CARE MEDICINE 15:10 453

Increasingly, it is now being recommended to maintain glycaemic control in the elective surgical patient by manipulating the patient's usual medication. This however requires the fulfilment of a few criteria, which are:

- surgery can be carried out early on a morning or afternoon list
- *short starvation period (only one missed meal)*
- good diabetes control prior to admission (HbA_{1C} <8.5%)
- high probability that the patient will self-manage their diabetes during the immediate post-operative period.

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Perioperative management of diabetic patients: new controversies

P. Aldam[1], N. Levy[2*] and G. M. Hall[3]

[1] Division of Anaesthesia, Addenbrookes Hospital, Cambridge CB2 0QQ, UK
[2] Department of Anaesthesia, West Suffolk Hospital, Bury St Edmunds IP33 2QZ, UK
[3] Department of Anaesthesia, St George's Hospital Medical School, London SW17 0RE, UK

* Corresponding author. E-mail: nicholas.levy@wsh.nhs.uk

We suggest that preoperative $HbA1_c$ values should be determined in all patients undergoing major surgery, and also in all elective surgical patients with diabetes. Not only will this strategy diagnose DM in some patients with undiagnosed DM, it may also influence the timing of elective surgery. Glycated haemoglobin values >8.6% or 70 mmol mol^{-1} were associated with a four-fold increase in mortality after cardiac surgery.[15] Delaying elective major surgery while glycaemic control is improved is predicted to decrease mortality and serious morbidity—an objective that patient and clinician will surely support!

Diabetes complications and perioperative considerations

Complication	Perioperative Implication
Cardiovascular disease	
Myocardial ischemia/infarction Stroke Heart failure	Major cause of perioperative morbidity and mortality
Autonomic neuropathy	
Cardiovascular	Risk of arrhythmia, consider telemetry
Cystopathy	Urinary retention, increased risk of UTI
Gastroparesis	Delayed gastric emptying, risk of reflux
Hypoglycemia unawareness	More frequent glucose monitoring
Nephropathy	Avoid IV contrast/nephrotoxic agents Appropriate hydration Monitor renal function
Peripheral neuropathy	Risk of skin breakdown, ulceration
Retinopathy	Can acutely worsen with blood loss
Cheiroarthropathy	Difficult intubation, positioning and IV access
Impaired immunity/wound healing	Surgical site infection

Abbreviations: IV, intravenous; UTI, urinary tract infection.

Anesthesiology Clin 34 (2016) 155–169

Neuropatia autonomica

- Aumentata sensibilità ad anestetici e se
  (Insufficienza cardio-respiratoria (fino all'arres
- Gastroparesi (polmoniti ab ingestis)
- Atonia vescicale (ritenzione urinaria)
- Variazioni F.C. < 5 b/m' (Riscontrate in tutt
  con arresto c.c.)

↓

Monitoraggio post-operatorio 24÷72 h

Valutazione della terapia ipoglicemizzante: durante il ricovero è probabile che il paziente debba essere trattato con insulina soprattutto in caso di intervento chirurgico maggiore; in questi casi si consiglia di adottare uno schema basal-bolus.
Per i pazienti ben controllati con il solo trattamento ipoglicemizzante orale questo può essere mantenuto tenendo conto delle caratteristiche dei vari farmaci ipoglicemizzanti e delle loro controindicazioni **(Tabella 2),** in particolare conviene sospendere le sulfaniluree a lunga durata d'azione (es: glibenclamide) e la metformina. Per i pazienti diabetici in sola terapia dietetica monitorare la glicemia ed intervenire farmacologicamente (con insulina) se compare iperglicemia.

Tabella 2 ♦ Uso degli ipoglicemizzanti nel periodo perioperatorio

CLASSE	RACCOMANDAZIONI
Metformina	Sospendere 48 ore prima dell'intervento, ripresa nel postoperatorio (alla ripresa dell'alimentazione) se la glicemia è stabile e la creatininemia è confermata nella norma. Controindicazioni: scompenso cardiaco, stati ipossici, esami contrastografici
Sulfaniluree	Sospendere il giorno dell'intervento e ripresa nel postoperatorio (alla ripresa dell'alimentazione)
Inibitori α-Glucosidasi	Sospendere il giorno dell'intervento e ripresa nel postoperatorio (alla ripresa dell'alimentazione)
Tiazolidinedionici	Sospendere il giorno intervento, ripresa nel postoperatorio (alla ripresa dell'alimentazione). Attenzione alla ritenzione di liquidi. Non riutilizzare se nel periodo perioperatorio compare insufficienza cardiaca
Meglinitidi	Sospendere giorno dell'intervento, ripresa nel postoperatorio (alla ripresa dell'alimentazione)
Analoghi GLP1	Sospendere giorno dell'intervento, ripresa nel postoperatorio (alla ripresa dell'alimentazione)°
Inibitori DPP4	Sospendere giorno dell'intervento, ripresa nel postoperatorio (alla ripresa dell'alimentazione)
Glifozine	Sospendere giorno dell'intervento, ripresa nel postoperatorio (alla ripresa dell'alimentazione se la funzionalità renale è nella norma)

° Exenatide a lento rilascio o Dulaglutide potrebbero già essere state assunte (somministrazione settimanale) attenzione alle possibili conseguenze di una ridotta mobilità intestinale.
N.B. in caso di associazioni precostituite seguire le indicazioni della tabella ed in caso di controindicazioni alla ripresa della terapia disgiungere i principi attivi in somministrazioni separate.

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[3] Department of Anaesthesia, St George's Hospital Medical School, London SW17 0RE, UK

* Corresponding author. E-mail: nicholas.levy@wsh.nhs.uk

Guidelines from NICE, the British National Formulary, and the drug manufacturer's datasheet all advise the **withdrawal of metformin before surgery, even 48 h before operation in one instance**. For patients undergoing surgery with a period of short starvation, **the NHS guidelines advise the continuation of metformin throughout the day of surgery** with the omission of the lunchtime dose if the drug is taken three times a day and provided certain criteria are fulfilled (no contrast medium is used, and the eGFR is .50 ml min21 1.73m).4 The NHS guidelines are at variance with established practice but are supported by recent guidance from the Royal College of Radiologists. **The Royal College of Radiologists recommend that there is no need to discontinue metformin after contrast in patients with serum creatinine within the normal reference range, eGFR .60 ml min, or both**, and in patients with impaired renal function, they suggest that any decision to stop it for 48 h should be made in consultation with the referring clinic.

The inconsistency highlights the confusion about the current use of metformin perioperatively. The NHS guidelines admit that there is limited evidence to support the perioperative recommendations on metformin. ***However, in a retrospective survey of 1284 diabetic cardiac surgical patients, it was found that those who continued with metformin, often inadvertently, had improved outcomes compared with those patients who omitted metformin as instructed.*** Whether such benefits may occur in general surgical patients has yet to be established. **At present, a rational conclusion is to continue metformin throughout the perioperative period in all patients with normal renal function**. This will enhance the activity of residual insulin secretion in type 2 diabetic patients.

Il "problema" metformina

n. 22 casi da overdose di metformina, la lattacidosi grave (pH ≤ 7.21, ≥ 11 mmol/l) si è osservata (n. 8 casi) solo se i livelli di metformina erar mg/dl. **E' consigliato non superare un livello di metformina > 10mg**

Livelli previsti di metformina plasmatica sulla base della dose giornaliera di metformina e del filtrato glomerulare

Metformina	1000 mg/die	1500 mg/die	2000 mg/die
eGFR 40 ml/min	2.8	4.2	5.6
30 ml/min	3.4	5.1	6.8
20 ml/min	4.4	6.6	8.8
10 ml/min	8.8	13.2	17.6

Adam WR and O'Brien RC. Diabetic Medicine, online before the print June 9, 2014

Il "problema" metformina

Dosi consigliate di metformina in pazienti con IRC

eGFR	Metformina: dose massima consigliata	Precauzioni aggiuntive
≥40	Nessuna limitazione	
30-39	2g/die	
20-29	1.5g/die	Misurare il lattato, ridurre o interrompere il trattamento se >3.5mmol/l
10-19	0.5g/die	Misurare il lattato, ridurre o interrompere il trattamento se >3.5mmol/l
<10	Non usare	
Dialisi stabile	0.5g/die, ma solo se GFR residuo >5ml/min	Misurare il lattato regolarmente. Interrompere il trattamento se >3.5mmol/l

Adam WR and O'Brien RC. Diabetic Medicine, online before the print June 9, 2014

Il "problema" metformina

Raccomandazioni sull'utilizzo dei medicinali a base di metformina nella gestione del diabete mellito di tipo 2

L'AIFA, in collaborazione con SID, AMD, SIMG, SIF, SIFO e FOFI, desidera fornirle delle raccomandazioni sul corretto utilizzo di metformina.

- sospendere, se possibile, temporaneamente il trattamento con metformina in corso di condizioni cliniche acute potenzialmente in grado di alterare la funzionalità renale, quali ipotensione grave, disidratazione o infezioni gravi;
- sospendere per un breve periodo (due giorni prima fino ad un giorno dopo) il trattamento con metformina in corso di interventi chirurgici, somministrazione intravascolare di mezzi di contrasto a base di iodio o altra procedura che possa comportare un rischio di insufficienza renale acuta.

AIFA, luglio 2011

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Ideal blood glucose range and measurement error

There is almost unanimity between the NHS guidelines and the American Association of Clinical Endocrinologists with the American Diabetes Association Consensus Statement that the ideal glucose range in hospital for non-critically ill diabetic patients should be 6–10 mmol litre (108-180 mg%) (in the USA, the lower limit is 100 mg dl or 5.6 mmol litre). There is considerable evidence that good glycaemic control decreases perioperative infection, morbidity, and mortality. **The NHS guidelines state that a range of 4–12 mmol litre (72-216 mg%) is also acceptable. *We argue that this extended range should not be used*. The upper limit of 12 mmol litre (216 mg%) is similar to the concentration that in vitro results in a variety of changes in endothelial function, expression of adhesion molecules, impaired neutrophil function, enhanced cytokine synthesis, and decreased complement activity which combine to exacerbate inflammation and increase the risk of infection. The lower limit of 4 mmol litre (72 mg%) is close to glucose values that, in some diabetic patients, will induce hypoglycaemic symptoms. Furthermore, safe use of the extended range will be critically dependent on accurate measurements of blood glucose values. It is salutary to note that the FDA in the USA allows a 20% error for glucose meters at concentrations above 100 mg dl (5.6 mmol litre) and a 15% error for values ,100 mg dl.** Thus, a measured concentration of 4 mmol litre will have an actual value between 3.4and4.6mmol litre,while a measured concentration of 12 mmol litre will have an actual value between 9.6 and 14.4 mmol litre

Glicemia pre-operatoria nel diabetico T2

	Diabetici con **infezioni** (n=20)	Diabetici senza **infezioni** (n=380)	p
Età	67.0±9.73	60.44±8.31	NS
BMI	26.90±1.7	26.6±3.9	NS
Durata malattia (anni)	9.79±7.52	6.38±6.43	NS
Glicemia 2 giorni prima intervento	**201±47**	**165±37**	**0.028**
Glicemia 1 giorno prima intervento	**174±36**	**136±30**	**0.012**
Glicemia postoperatoria (1 giorno)	208±41	190±35	NS
Glicemia postoperatoria (2 giorno)	156±20	170±33	NS
Glicemia postoperatoria (3 giorno)	155.6±32	154.2±26	NS

Studio retrospettivo su 1090 adulti, 400 con DMT2, sottoposti a chirurgia coronarica. Nel 5% dei DMT2 sono state diagnosticate infezioni post-operatorie: sternale superficiale (0.75%), sito donatore (1%), mediastinite (1.25%), IVU (1.5%), polmoniti (0.5%)

Guvener M, et al. Endocrine Journal 2002;49:531–537

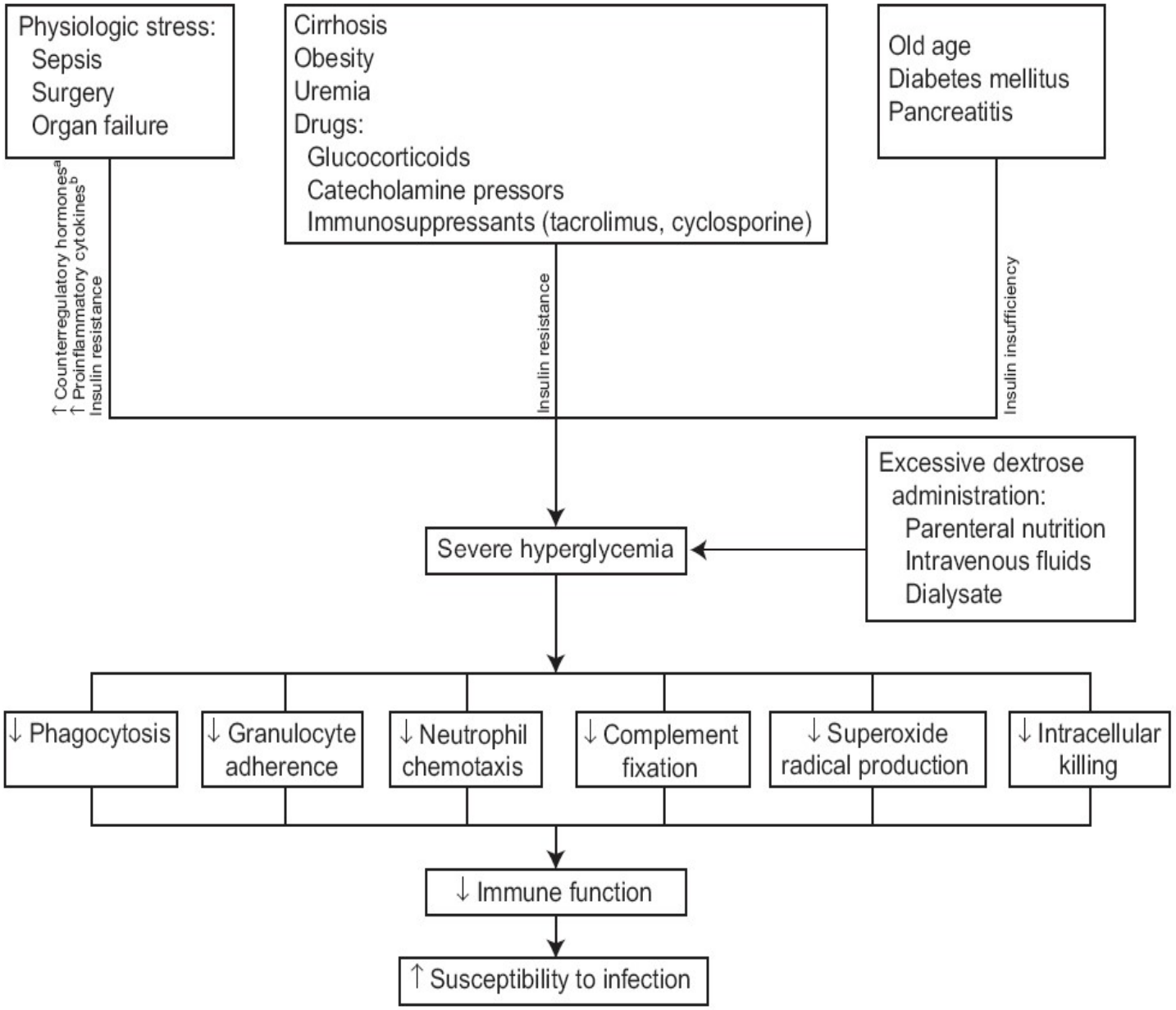

Fig. 1. Causes of hyperglycemia and effects of hyperglycemia on increased susceptibility to infection in the critically ill patient. [a] Counterregulatory hormones are glucagon, catecholamines, cortisol, and growth hormone, [b] Proinflammatory cytokines are tumor necrosis factor, interleukin (IL)-1 and IL-6. (*From* Butler SO, Btaiche IF, Alaniz C. Relationship between hyperglycemia and infection in critically ill patients. Pharmacotherapy 2005;25(7): 963–76; with permission.)

LA NUOVA DEFINIZIONE DELLE CLASSI DI ETÀ

- 0-10 • Bambini
- 11-20 • Adolescenti
- 21-25 • Giovani
- 26-35 • Giovani adulti
- 36-54 • Adulti
- 55-64 • Tardo adulti
- 65-74 • Giovani anziani
- 75-84 • Anziani
- 85 e più • Grandi anziani

Iperglicemia e ipoglicemia nel paziente anziano

Nell'anziano l'iperglicemia peggiora la prognosi come nel paziente giovane

Il rischio di iperglicemia prolungata è correlato nel paziente anziano ad un maggior rischio di disabilità.

Nel paziente anziano fragile l'ipoglicemia è un fattore di aumentata fragilità.

L'anziano presenta meno sintomi ma ha un maggior ritardo nel tempo di reazione e "si accorge" tardivamente dell'ipoglicemia e sviluppa quadri più gravi.

Arch Intern Med. 2003;163:1825-1829

DIABETES CARE, VOLUME 20, NUMBER 2, FEBRUARY 1997

Non solo ipoglicemie da sovradosaggio ipoglicemizzanti ma anche da interazioni farmacologiche

Original Investigation

Hypoglycemia After Antimicrobial Drug Prescription for Older Patients Using Sulfonylureas

Trisha M. Parekh, DO; Mukaila Raji, MD, MS; Yu-Li Lin, MS; Alai Tan, MD, PhD; Yong-Fang Kuo, PhD; James S. Goodwin, MD

Antimicrobial Drug[a]	Hypoglycemia	
	Mechanism	Evidence
Ciprofloxacin	Inhibits ATP K+ channels in pancreatic B-cells initiating insulin secretion[10,11] Enhances glucose-induced insulin secretion[10,11]	Shown to cause hypoglycemia in a cohort study[12]
Clarithromycin	May increase sulfonylurea level by inhibiting P-glycoprotein in the intestinal wall[13,14]	Shown to cause hypoglycemia in cohort studies[8,15]
Fluconazole	CYP2C9 inhibitor interfering with sulfonylurea metabolism[16]	Shown to cause hypoglycemia in cohort study[8]
Levofloxacin	Inhibits ATP-sensitive K+ channels affecting insulin release[10,11] May serve as P-glycoprotein inhibitor, which can increase concentrations of sulfonylureas[14,17]	Displayed hypoglycemic drug interactions with sulfonylureas in multiple studies[8,12,18]
Metronidazole	CYP2C9 inhibitor interfering with sulfonylurea metabolism[19,20]	May have lowered fasting plasma glucose level in hospitalized patients taking sulfonylureas[19]
Moxifloxacin	Enhances glucose-induced insulin secretion[10]	Conflicting evidence from cohort studies[19,21]
Sulfamethoxazole-trimethoprim	CYP2C9 inhibitor, interfering with sulfonylurea metabolism[8,22]	Hypoglycemia in cohort studies[8,9]

JAMA Intern Med. Publ.online September 1, 2014

***Si consiglia inoltre di*:**

1. valutare il rischio di iperglicemia se il paziente dovrà essere sottoposto a procedure stressanti o a farmaci iperglicemizzanti (esempio: terapia steroidea);

2. programmare l'intervento al mattino presto per non interferire troppo sul controllo glicemico;

3. mantenere il regime alimentare abituale;

4. organizzare il monitoraggio della glicemia in rapporto alle necessità del paziente;

5. istruire il personale alla gestione di eventuali crisi ipoglicemiche o iperglicemiche;

6. richiedere per tempo la consulenza diabetologica.

§Protocollo di Gestione Chirurgica del paziente con diabete in ospedale (raccomandazioni principali):

- **Monitorare la glicemia** per mantenerla nei definiti obiettivi glicemici, evitando oscillazioni glicemiche
- **Controllare** la glicemia prima della sedazione, monitorare con maggiore intensità la glicemia durante l'anestesia (almeno una volta all'ora)
- **Correggere** la glicemia se fuori dall'obiettivo sia mediante supplementi insulinici sc o avvio d'infusione insulinica ev sia con soluzioni glucosate in caso di ipoglicemia, secondo protocolli concordati
- Prevenire il rischio di **lesioni da decubito**, in particolare ai piedi
- Utilizzare tecniche anestesiologiche che riducano la nausea e il vomito postoperatorio al fine di favorire una rapida **ripresa dell'alimentazione per os**
- Utilizzare una strategia di analgesia post-operatoria che non induca nausea e vomito al fine di favorire una rapida ripresa dell'alimentazione per os (es. blocchi continui o infiltrazione ferita chirurgica con anestetici a lunga durata d'azione)

Profilo Di Cura Del Paziente Diabetico Ricoverato In Ambito Chirurgico - 2013

Fase preoperatoria: giorno e notte prima dell'intervento :

1) il paziente può mantenere l'usuale dieta a meno che non siano previste preparazioni specifiche per interventi/procedure a livello intestinale;

2) la glicemia va controllata prima e due ore dopo i pasti;

3) i pazienti in terapia insulinica devono intensificare il controllo e correggere eventuali iperglicemie;

4) i pazienti diabetici in terapia con sola dieta possono generalmente rimanere a digiuno per 12-18 ore; se il digiuno si protrae o in pazienti più scompensati dal punto di vista metabolico (HbA1c >8%) usare una infusione di soluzione glucosata tamponata con insulina secondo necessità

5) usare soluzioni glucosate più concentrate e velocità di infusione ridotte (accesso venoso centrale) se vi è un rischio di sovraccarico di liquidi;

6) in caso di iperglicemia (>250 mg/dl) controllare anche la chetonuria o la chetonemia; qualsiasi procedura ambulatoriale deve essere posposta in presenza di disidratazione severa da scompenso glicemico, chetoacidosi e scompenso iperosmolare;

7) se in terapia con insulina ad azione intermedia-lenta senza rapida a pasti, somministrarne il 50% della dose la sera precedente l'intervento/procedura;

8) se in terapia con schema basal-bolus somministrare il 50-70% di NPH o il 70-100% di analogo lento (glargine, detemir, degludec); l'entità della riduzione dipende dalla propensione del paziente a sviluppare ipoglicemia notturna o a digiuno;

9) se in terapia con microinfusore mantenere la dose basale o ridurla se propensione all'ipo notturna o a digiuno;

10) in caso di terapia con insuline premiscelate due volte al giorno la sera somministrare il 50% della dose programmata.

Fase preoperatoria: giorno dell'intervento

1) sospendere la terapia insulinica rapida (o i boli per chi è in trattamento con microinfusore) prevista per colazione;

2) se previste iniezioni di insulina ad azione lenta o intermedia al mattino somministrare 75-100% della dose di analogo lento o 50-70% della dose di insulina intermedia o 50-75% della dose di componente ad azione intermedia di una insulina premiscelata;

3) sospendere la terapia orale, compresi gli analoghi del GLP1;

4) monitorare la glicemia ogni 2 ore;

5) somministrare boli di insulina rapida s.c. per correggere eventuali iperglicemie durante la procedura.
È consigliato mantenere le glicemie <180 mg/dl evitando i rischi dell'ipoglicemia connessi ad un controllo più stretto.

Alcuni farmaci comunemente impiegati in anestesia come la ketamina, il fentamil, midazolam, l'alotano, l'enfluorano e l'isoflorano possono aumentare la glicemia.

Fase intraoperatoria (anestesista)

<u>Per interventi cardiovascolari o di lunga durata</u>:

1) mantenere il controllo glicemico durante l'intervento e somministrare in 1° via glucosate a concentrazioni e volumi in rapporto alle esigenze del paziente senza superare i 5 g/kg/24 ore;

2) regolare la velocità di infusione dell'insulina (2° via) secondo lo schema del protocollo utilizzato;

3) per procedure ambulatoriali di breve durata è possibile ricorrere alla terapia insulinica per via sc.:boli correttivi s.c. possono essere somministrati in caso di glicemia superiore a 180-200 mg/dl.

Fase postoperatoria:

1) misurare la glicemia ogni 4 ore e somministrare 2-4 U di analogo rapido s.c. se la glicemia dovesse superare i 150 mg/ dl o 4-6 U se maggiore di 200 mg/dl; in caso di persistenza di valori costantemente elevati (se supera per due volte i 180 mg/dl) passare all'infusione "intensiva";

2) nel paziente in trattamento preoperatorio con sola dieta, se l'intervento non è stato particolarmente impegnativo (minima sofferenza tissutale) - intervento chirurgico "minore"e se non vi sono segni di infezione acuta è possibile che non si debba fare ricorso all'insulina;

3) modificare le dosi di insulina in rapporto ai valori glicemici misurati > vedi oltre

4) in caso di intervento maggiore mantenere l'infusione di soluzione glucosata con insulina, il fabbisogno minimo giornaliero di carboidrati è di 100 g (400 Kcal); nell'immediato post-operatorio la somministrazione di glucosio fornisce l'energia per i tessuti a metabolismo glucosio-obbligati e riduce il catabolismo proteico a scopo gluconeogenetico;

5) lo schema di infusione per via e.v. deve essere scelto in base alle caratteristiche del reparto (intensivo, semi-intensivo, corsia) ed all'addestramento del personale infermieristico;

6) alla ripresa dell'alimentazione entro le 24 ore, somministrare la terapia ipoglicemizzante praticata prima dell'intervento eventualmente con una riduzione delle dosi in considerazione di un eventuale minor introito calorico nei primi giorni (per ripresa dell'alimentazione si intende l'assunzione per os di almeno il 50% del fabbisogno calorico) >vedi oltre

7) in caso di ripresa dell'alimentazione oltre le 24 ore o in caso di interventi particolarmente importanti oppure se le condizioni del paziente lo richiedono passare subito nel post-operatorio ad uno schema di infusione "intensiva endovenosa".

Ripristino della terapia sottocutanea nella fase post-critica

La terapia insulinica per via e.v. termina quando:

1) il paziente riprende l'alimentazione per os (almeno il 50% del fabbisogno),

2) il paziente viene trasferito dall'unità intensiva o subintensiva alla corsia normale dove la gestione dell'infusione continua di insulina può essere difficile.

Per effettuare il passaggio da terapia insulinica per via e.v. alla via s.c. è necessario calcolare le quantità di insulina che il paziente ha ricevuto nelle ultime 24 ore al fine di ottenere il fabbisogno insulinico giornaliero. Tale fabbisogno (prudentemente ridotto del 20%) deve essere somministrato per il 50% come insulina basale e per il 50% come insulina prandiale (suddivisa equamente tra i tre pasti). La prima somministrazione dell'analogo basale deve essere somministrato 2-4 ore prima di sospendere la terapia insulinica endovena. Per i pazienti diabetici in buon controllo prima dell'intervento senza terapia insulinica, può essere presa in considerazione la ripresa della terapia precedente, se le condizioni cliniche lo permettono. Se il controllo precedente all'intervento non è giudicato adeguato si consiglia di mantenere la terapia insulinica s.c. Indispensabile una revisione della terapia ipoglicemizzante allo stabilizzarsi delle condizioni generali del paziente.

Tabella 4 ♦ Variazioni delle dosi di insulina nel postoperatorio (17)

INTERVENTO CHIRURGICO MAGGIORE	INTERVENTO CHIRURGICO MINORE			
	Glicemia <70 mg/dl	Glicemia 70-100 mg/dl	Glicemia 101-180 mg/dl	Glicemia >180 mg/dl
Terapia insulinica e.v.	Somministrare 100 ml glucosata 10% e.v. oppure 25-50 ml al 33% controllo glicemia ogni 15 min.	Somministrare glucosata 5% alla velocità di 40 ml/ora controllo glicemico ogni ora	Mantenere la terapia ipoglicemizzante in atto. Monitorare la glicemia ogni 2 ore	Iniziare terapia insulinica e.v. o insulina s.c.

Tabella 5 ♦ Ripresa dell'alimentazione per os (18)

IL PAZIENTE È IN GRADO DI ALIMENTARSI (ALMENO IL 50% DELLA DIETA PRESCRITTA)?	
SI	NO
Riprendere il regime terapeutico precedente (insulina o ipoglicemizzanti orali): controllare la creatininemia prima di riprendere la terapia con metformina.	Mantenere la terapia insulinica e.v. o s.c. secondo le condizioni cliniche. Considerare la terapia infusionale se le glicemia sono superiori a 180 mg/dl.

PAZIENTE DIABETICO ADULTO DA SOTTOPORE AD ESAMI DIAGNOSTICI

La preparazione necessaria alla corretta esecuzione di procedure diagnostiche modifica la normale routine quotidiana soprattutto per quanto riguarda l'alimentazione e questo può interferire con la gestione del diabete.

Dieta preparatoria

In caso di esami che richiedono una lunga preparazione con una dieta priva di scorie sarà probabilmente necessario ridurre la somministrazione di insulina (ridurre sia l'insulina pronta somministrata ai pasti sia l'insulina ritardo somministrata la sera precedente) e mantenere un frequente controllo della glicemia (prima dei pasti e 2 ore dopo i pasti). In caso di ipoglicemia somministrare zucchero per bocca (15 g), rivalutare la glicemia dopo 15 minuti, e se necessario ripetere la somministrazione di zucchero. Controllare la glicemia sino alla risoluzione dell'episodio ipoglicemico

Assunzione di purganti e altri farmaci

La somministrazione di lassativi drastici (solfato di magnesio) deve essere attuata con prudenza per la possibile concomitanza di complicanze neuropatiche (alterazioni dell'alvo, ipotensione ortostatica, tachicardia ecc.) e dove possibile, in collaborazione con il servizio di diagnostica, sostituita con rettoclisi o farmaci per bocca privi di glucidi. Nei pazienti in trattamento con analoghi del GLP1 potrebbe peggiorare la nausea.

Idratazione

L'idratazione non è controindicata nel diabete tuttavia occorre prestare attenzione alla possibilità di sovraccarico idrico in pazienti che potrebbero essere portatori di una cardiopatia silente (e in terapia con tiazoledinedionici) o di insufficienza renale lieve trattati con meformina (eventualmente ridurre i liquidi secondo le condizioni emodinamiche). La metformina può essere mantenuta quando la velocità stimata di filtrazione glomerulare scende sotto i 60 ml/min/1.73m2, mentre se raggiunge i 45 ml/min/1.73 m2 la dose deve essere dimezzata e sospesa se inferiore a 30) Rimangono valide le indicazioni di bere acqua (sino a 3 litri die nelle 4-5 ore successive alla somministrazione di lassativi) purché siano valutate le condizioni cardiache.-

Tabella 7 • Variazioni alla terapia ipoglicemizzante in caso di procedura diagnostica (21-23)

	GIORNO PRIMA	GIORNO ESAME	RIPRESA TERAPIA
Metformina	Se la procedura comporta la somministrazione di mezzo di contrasto interrompere la metformina 48 ore prima	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione se la funzionalità renale è nella norma
Inibitori α-glicosidasi	Mantenere la somministrazione	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione
Sulfoniluree a breve durata (gliclazide, glipizide)	Mantenere la somministrazione	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione
Sulfoniluree a lunga durata (glibenclamide)	Sospendere	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione
Meglitinidi	Mantenere la somministrazione	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione
Tiazolidinedionici	Mantenere la somministrazione	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione
Inibitori DDP4	Mantenere la somministrazione	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione
Analoghi GPL1	Sospendere	Non somministrare durante il digiuno	Riprendere la terapia solo dopo aver escluso la possibilità di complicanze come: pancreatite acuta o inflammatory bowel disease
Analoghi GLP1 settimanali	Sospendere	Non somministrare durante il digiuno	Riprendere la terapia solo dopo aver escluso la possibilità di complicanze come: pancreatite acuta o nflammatory bowel disease
Gliflozine	Mantenere la somministrazione	Non somministrare durante il digiuno	Riprendere la terapia alla ripresa dell'alimentazione se la funzionalità renale è nella norma
Analoghi lenti insulina somministrati la sera	Mantenere la somministrazione	Somministrare la sera dell'intervento se è prevista la ripresa dell'alimentazione il giorno successivo riducendo la dose del 50%	Riprendere la terapia alla ripresa dell'alimentazione
Analoghi lenti insulina somministrati al mattino	Mantenere la somministrazione	Somministrare la dose abituale ridotta del 50% se è prevista la ripresa dell'alimentazione il giorno successivo vedi sopra	Riprendere la terapia alla ripresa dell'alimentazione
Analoghi rapidi insulina	Mantenere la somministrazione in relazione al tipo di preparazione prevista (pasti privi di scorie, digiuno serale...)	Non somministrare durante il digiuno.	Riprendere la terapia alla ripresa dell'alimentazione
Insuline premiscelate	Mantenere la somministrazione in relazione al tipo di preparazione prevista (pasti privi di scorie, digiuno serale...)	Non somministrare durante il digiuno. Vedi sopra	Se il regime BD (???) viene riattivato a pranzo somministrare il 50% della dose abituale del mattino
Microinfusore	Mantenere la dose basale abituale e valutare i boli in relazione al tipo di preparazione prevista (pasti privi di scorie, digiuno serale...)	Mantenere la dose basale, eventualmente ridotta all'80% se il digiuno si protrae. Alcune procedura possono richiedere la rimozione della pompa (CT, RM, radioterapia, cardioversione elettrica...) (19)	Riprendere la terapia alla ripresa dell'alimentazione

CASI PARTICOLARI

PET

Per una corretta sensibilità dell'esame è necessario che la glicemia a digiuno prima dell'esame **sia inferiore a 200 mg/dl (11.1 mmol/l),** con valori superiori l'esame non può essere condotto.

L'American Society of Nuclear Medicine suggerisce l'uso di insulina a domicilio se i valori glicemici superano i 200 mg/dl, tuttavia la somministrazione del 18F-FDG deve essere ritardata nella giornata rispetto ai pazienti non diabetici perché l'insulina stessa, somministrata a digiuno, determina un aumento della captazione a livello cardiaco, muscolare, adiposo ed epatico ma non ha effetti sulla captazione delle masse neoplastiche In conclusione si consiglia di programmare l'esame al termine della mattina, dopo aver assunto 3-5 ore prima la colazione e la normale terapia ipoglicemizzante (non assumere metformina), in tutti i pazienti si dovrà comunque valutare la glicemia prima dell'inizio del test.

SOCIETÀ ITALIANA DI ANESTESIA ANALGESIA
RIANIMAZIONE E TERAPIA INTENSIVA

LINEE GUIDA per il DIGIUNO PREOPERATORIO nel PAZIENTE in ELEZIONE o URGENZA DIFFERIBILE

ADULTI

MATERIALE INGERITO	PERIODO MINIMO DI DIGIUNO
Liquidi chiari (acqua, the chiaro, caffè nero, succhi di frutta senza polpa) max 150 cc	2 ORE
Solidi (no grassi) e latte	6 ORE
Solidi (cibi grassi, carne, etc)	8 ORE

Anesthesiology
55:104–109, 1981

Perioperative Management of Diabetes Mellitus

Leonard F. Walts, M.D., Jordan Miller, M.D.,† Mayer B. Davidson, M.D.,‡ Josiah Brown, M.D.§*

Hourly plasma glucose concentrations in 191 diabetic patients undergoing 200 operations were measured. The glucose infusion rate was controlled. Insulin-taking diabetics given no insulin or a fraction of their usual dose preoperatively developed rising plasma glucose concentrations beginning with the start of operation. The mean rate was 22 $mg \cdot dl^{-1} \cdot h^{-1}$ (no insulin) and 17 $mg \cdot dl^{-1} \cdot h^{-1}$ (one-half to one-fourth the usual dose of insulin). Eight per cent of the patients achieved plasma glucose concentrations greater than 400 mg/dl. Patients given regular insulin during the operation had no hourly rise in plasma glucose. However, hypoglycemia occurred in 5.5 per cent of these patients.

The authors suggest that arbitrary management regimens should be abandoned. Plasma glucose levels should be measured frequently and insulin and/or sugar should be given to each patient as needed. (Key words: Complications: diabetes mellitus. Hormone: insulin. Metabolism: diabetes; glucose; insulin; hyperglycemia; hypoglycemia.)

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A retrospective review of the assessment of current perioperative management of diabetes in patients undergoing knee replacement surgery

Alan J Howieson[1], Annmarie Brunswicker[1] and Ketan Dhatariya[2]

[1]Department of Orthopaedic Surgery, Norfolk and Norwich University Hospitals, NHS Foundation Trust, Norwich, UK
[2]Diabetes and Endocrinology, Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospitals, NHS Foundation Trust, Norwich, UK
Corresponding author: Ketan Dhatariya. Email: ketan.dhatariya@nnuh.nhs.uk

Table 1. A comparison of our findings, compared to the audit standard goals.

Criteria	Standard	Results
Primary care referrals contain all suggested information	100%	0%
Patients preoperatively assessed	100%	100%
Patients with diabetes management plan	100%	18%
Admitted on day of surgery	90%	100%
Listed first on list	95%	34%
Length of stay	No longer than 10% greater than average	12% greater than average
Patients receive hourly blood glucose monitoring during their procedure, and in recovery	100%	10%
Patients' blood glucose maintained between 4–12 mmol/L	100%	26%
Patients with delayed discharge due to diabetes	0%	0%

These audit standards were set out in the 2011 NHS Diabetes document: Management of adults with diabetes undergoing surgery and elective procedures: improving standards.[3]

3. Dhatariya K, Flanagan D, Hilton L, Kilvert A, Levy N, Rayman G, et al. Management of adults with diabetes undergoing surgery and elective procedures: improving standards. Available from: http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm (last accessed 6 Nov 2013).

Table 2. The minimum amount of information that Ref. 3 suggests should be included in a standardized GP referral letter to a surgical outpatient for a person with diabetes.

- Duration and type of diabetes
- Place of usual diabetes care (primary or secondary)
- Other co-morbidities
- Treatment
  - for diabetes oral agents/insulin doses and frequency
  - for other co-morbidities
- Complications
  - at-risk foot
- Renal impairment
- Cardiac disease
- Relevant measures
  - BMI
  - BP
  - HbA1c result (to be done within the three months prior to referral)
  - eGFR

In England and Wales, all of these data (except the most up to date HbA1c within three months of referral) should be collected either as good clinical practice or part of their Quality and Outcomes Framework (QoF).

Conclusion

Our study has shown, in agreement with previous data, that the perioperative care of patients with diabetes is still suboptimal. Poor long-term glycaemic control is likely to be associated with worse clinical outcomes and, in line with the NHS Diabetes national guideline for the perioperative management of patients with diabetes undergoing surgery, it may be prudent to delay surgery until the preoperative HbA1c is under 69 mmol/mol (8.5%).

Perioperative Management of Patients with Diabetes Undergoing Ambulatory Elective Surgery

Kathryn E. Coan, M.D.,[1] Andrew B. Schlinkert,[1] Brandon R. Beck, B.A.,[1] Danielle J. Haakinson, M.D.,[1] Janna C. Castro, B.S.,[2] Richard T. Schlinkert, M.D.,[2] and Curtiss B. Cook, M.D.[3]

Abstract

Objective:

The objective was to assess processes of care for patients with diabetes undergoing elective surgery.

Methods:

A retrospective review of medical records was conducted to determine frequency of perioperative glucose monitoring, changes in glucose control, and treatment of intraoperative hyperglycemia.

Results:

A total of 268 patients underwent 287 elective procedures. Mean age was 67 years, 63% were men, 97% had type 2 diabetes, and most (57%) were treated with oral hypoglycemic agents. Average perioperative time was approximately 8 h. Mean preoperative hemoglobin A1c was 7.0%; however, this value was checked in only 52% of cases. A glucose measurement was obtained in 89% of cases in the preoperative area and in 87% in the postanesthesia care unit, but in only 33% of cases did a value get checked intraoperatively. Average glucose was 139 mg/dl preoperatively, increasing to 166 mg/dl postoperatively (p <.001). Glucose levels increased regardless of type of outpatient medical therapy used to treat hyperglycemia, except for those on combination oral agents plus insulin (p =.06).

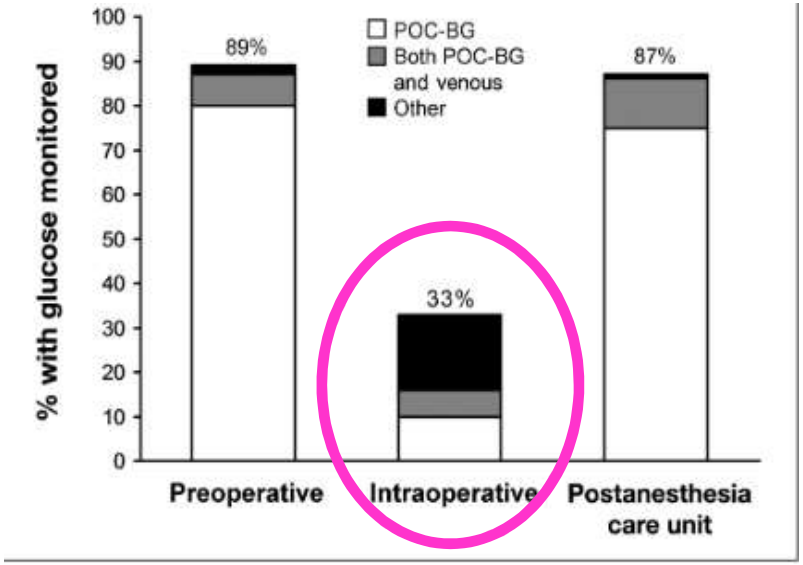
Conclusions:

These data indicate suboptimal documentation of outpatient hemoglobin A1c. Intraoperative glucose monitoring seldom occurred, despite prolonged periods under anesthesia and perioperative deterioration of glycemic control. Standards need to be developed and interventions are needed to enhance management of diabetes patients undergoing elective procedures.

J Diabetes Sci Technol 2013;7(4):983–989

Table 2.
Distribution of 287 Surgical Procedures by Type of Surgical Service

Type of surgical service	Procedures, *n* (%)
Urology	62 (22)
Orthopedic	59 (21)
General	43 (15)
Transplant	29 (10)
Otolaryngology	26 (9)
Vascular	20 (7)
Neurosurgery	13 (4)
Gynecology	12 (4)
Plastics	10 (4)
Colorectal	9 (3)
Cardiothoracic	4 (1)



igure 2. Blood glucose monitoring defined by perioperative phase and ype of monitoring performed. Other denotes a laboratory test other han a point-of-care blood glucose measurement.

Take Home Messages

- **Programmare** l'intervento nel paziente diabetico quando glicemia, idratazione e compenso elettrolitico sono ottimizzati
- **Contestualizzare le Linee Guida** sulla cura del paziente diabetico in Ospedale
- **Condividere** le stesse con Primary Care, Chirurgia, Rianimazione, Diabetologia, Servizio Infermieristico, Laboratorio, Direttori di Strutture, Centro Elaborazione dati, Direzione Sanitaria (GLAM)

DUBIUM SAPIENTIAE INITIUM

Cartesio

Preoperative Evaluation

- Metabolic control and any diabetes-associated complications
- **Cardiovascular disease**: resting ECG, stress test
- **Cardiac autonomic neuropathy**: may predispose patients to perioperative hypotension; the presence of resting tachycardia, orthostatic hypotension, peripheral neuropathy, and loss of normal respiratory heart rate variability should be sought.
- **Renal dysfunction**: serum creatinine, 24hr Ccr, proteinuria or abnormal creatinine clearance have a greater risk of developing acute renal failure.

Common clinical presentations of autonomic dysfunction

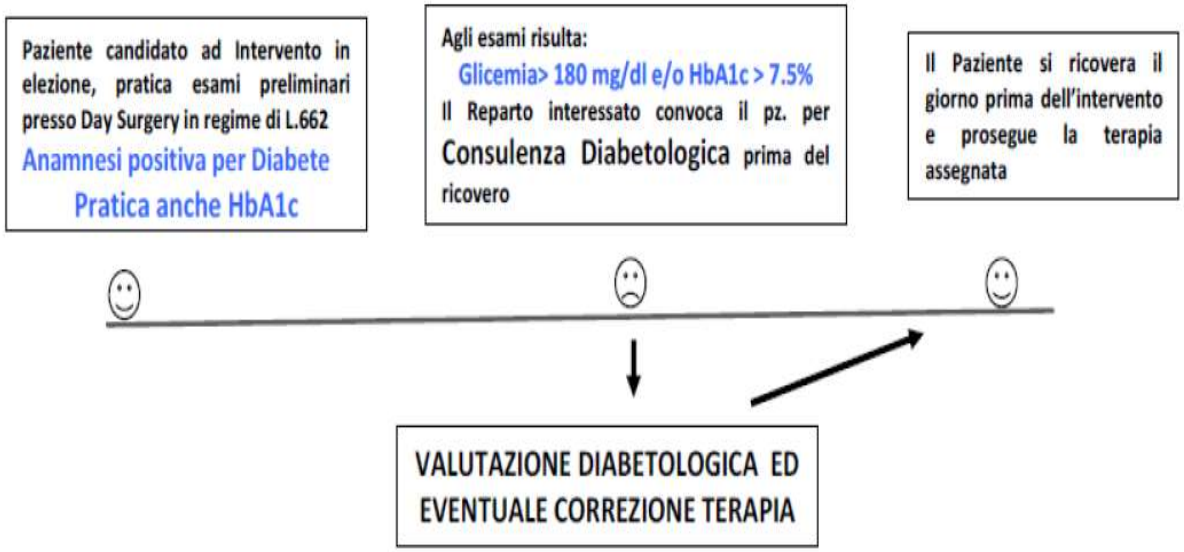
Organ System	Symptoms	Comments
CAN	• Resting tachycardia	Dominant sympathetic system
	• Loss of heart rate variability	Earliest manifestation of CAN
	• Postural hypotension	
	• Exercise intolerance	Indicates inability to increase heart rate, blood pressure, and cardiac output
	• Dizziness	
	• Silent ischemia	
	• Abnormal baroreceptor responsiveness	
Genitourinary	• Impotence	
	• Urinary retention	
Gastrointestinal	• Gastroparesis	
	• Diarrhea	
Peripheral	• Abnormal sweating	
	• Inability to perceive hypoglycemia	

Abbreviation: CAN, cardiovascular autonomic neuropathy.

Anesthesiology Clin 34 (2016) 155–169

PROPOSTA DI LINEE GUIDA PER IL TRATTAMENTO DEL DIABETE E DELL'IPERGLICEMIA NELLE STRUTTURE DI RICOVERO DELL'AORN OSPEDALI DEI COLLI (MONALDI, COTUGNO, CTO) NAPOLI

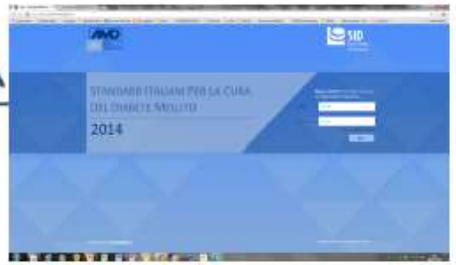
UOD Metabolica Responsabile Dott. M. Rinaldi
Medicina Interna Direttore Dott. L. Ussano



In collaborazione con le UOC di Anestesia e TIPO Plesso Monaldi
UOC Cardiologia ed Emodinamica Plesso Monaldi

Elaborate da *Dr Massimo Rinaldi*
Dr Ada Maffettone

- Ci sono **evidenze insufficienti per stabilire un valore limite di HBA_{1c}** e i rischi associati al cattivo compenso glicemico vanno soppesati in relazione alla necessità dell'intervento. **Un valore limite tra 64-75 mmol/mol (8-9%) è accettabile**, ma target più alti possono essere appropriati per pazienti ad alto rischio ipoglicemico (Dhatariya K et al. Diabet Med 2012)



Standard Italiani di cura 2014

Gli obiettivi glicemici

Gli obiettivi glicemici durante un ricovero ospedaliero possono essere differenziati in funzione delle diverse situazioni cliniche:

- Pazienti in situazione critica, ricoverati in Terapia Intensiva, medica o chirurgica: valori glicemici 140-180 mg/dl, in funzione del rischio stimato di ipoglicemia.
  (Livello della prova II, Forza della raccomandazione B)

- Pazienti in situazione non critica: valori glicemici preprandiali <140 mg/dl, postprandiali <180 mg/dl o valori random <180 mg, se ottenibili senza rischi elevati di ipoglicemia. Target più stringenti possono essere perseguiti in soggetti clinicamente stabili e in precedente controllo glicemico ottimale. Target meno stringenti possono essere accettati in presenza di severe comorbilità.

(Livello della prova VI, Forza della raccomandazione B)

In alcune situazioni cliniche a elevato rischio di ipoglicemia è opportuno un innalzamento degli obiettivi glicemici.
(Livello della prova VI, Forza della raccomandazione B)

http://www.standarditaliani.it/home.php

Why is pre-op glycemic control important?

- Poor glycemic control
  - Increases dehydration and electrolyte abnormalities
  - Impairs collagen formation and decreases surgical wound strength
  - Increases risk of complications
- Medications for diabetes management associated with risks

Diabetes and Hyperglycemia in the Surgical Setting

Nate DeFelice, MD[a], Rachel E. Thompson, MD, MPH, SFHM[b,*]

[a] Department of Medicine, University of Washington, Seattle, WA, USA; [b] Division of General Internal Medicine, 986435 Nebraska Medical Center, Omaha, NE 68198-6435, USA
* Corresponding author.
E-mail address: rachel.thompson@unmc.edu

Hosp Med Clin 5 (2016) 189–204
http://dx.doi.org/10.1016/j.ehmc.2015.11.006
2211-5943/16/$ – see front matter

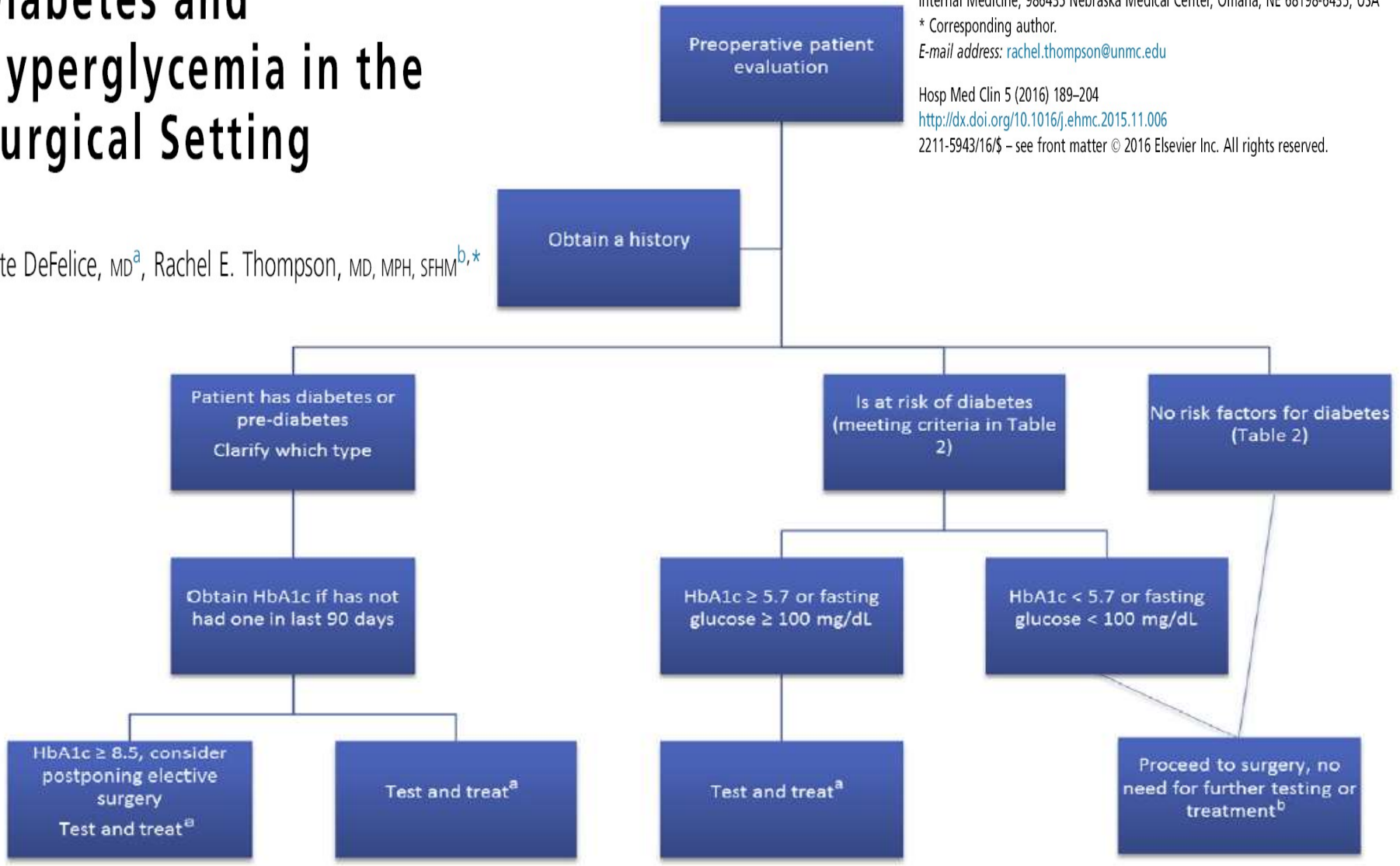


Fig. 2. Preoperative assessment of patients' perioperative glycemic treatment needs. [a] Should get glucose testing at minimum 4 times a day and insulin coverage to maintain glucose levels less than 180 mg/dL. [b] There are select patients who may need further testing and treatment depending on the clinical situation to ensure glucose levels remain less than 180 mg/dL.

Elements of preoperative diabetes risk assessment

1. Diabetes type
2. Disease duration/context of initial diagnosis
3. If type 1 diabetes: coexisting autoimmune diseases, history of DKA
4. Known complications
5. Associated comorbidities
6. Home diabetes regimen (oral agents, insulin type/frequency, last medication adjustment)
7. Frequency/severity of hypoglycemia
8. Hemoglobin A1c (if known)
9. Renal function
10. If insulin pump use, obtain settings from patient or primary endocrinologist

Abbreviation: DKA, diabetic ketoacidosis.

Anesthesiology Clin 34 (2016) 155–169

Diabetes complications and perioperative considerations

Complication	Perioperative Implication
Cardiovascular disease	
Myocardial ischemia/infarction Stroke Heart failure	Major cause of perioperative morbidity and mortality
Autonomic neuropathy	
Cardiovascular	Risk of arrhythmia, consider telemetry
Cystopathy	Urinary retention, increased risk of UTI
Gastroparesis	Delayed gastric emptying, risk of reflux
Hypoglycemia unawareness	More frequent glucose monitoring
Nephropathy	Avoid IV contrast/nephrotoxic agents Appropriate hydration Monitor renal function
Peripheral neuropathy	Risk of skin breakdown, ulceration
Retinopathy	Can acutely worsen with blood loss
Cheiroarthropathy	Difficult intubation, positioning and IV access
Impaired immunity/wound healing	Surgical site infection

Abbreviations: IV, intravenous; UTI, urinary tract infection.

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Glicemia ed infezioni

- L'iperglicemia :
- ↓ la liberazione di interleuchina 1 dai macrofagi
- ↓ il rilascio di O2 dai neutrofili
- ↓ la fagocitosi da parte dei macrofagi.

- In conclusione => ↑ infezioni locali e setticemie

The Obesity Surgery Mortality Risk Stratification score (OS-MRS) (Table 4) has been validated for patients undergoing gastric bypass surgery to identify the risk factors associated with mortality [43]. It includes features of metabolic syndrome and sleep-disordered breathing. Although only validated for bariatric surgical patients, it may be applicable to obese patients undergoing non-bariatric operations. Patients who score 4–5 on the OS-MRS are more likely to require closer postoperative monitoring.

Anaesthesia 2015, 70, 859–876 doi:10.1111/anae.13101

Guidelines

Peri-operative management of the obese surgical patient 2015

Association of Anaesthetists of Great Britain and Ireland
Society for Obesity and Bariatric Anaesthesia

Members of the Working Party: C. E. Nightingale,[1] M. P. Margarson,[1] E. Shearer,[1] J. W. Redman,[1] D. N. Lucas,[2] J. M. Cousins,[1] W. T. A. Fox,[1] N. J. Kennedy,[1] P. J. Venn,[3] M. Skues,[4] D. Gabbott,[5] U. Misra,[2] J. J. Pandit,[7] M.T. Popat[6] and R. Griffiths (Chair)[7]

1 Society for Obesity and Bariatric Anaesthesia, 2 Obstetric Anaesthetists' Association, 3 Royal College of Anaesthetists, 4 British Association of Day Surgery, 5 Resuscitation Council (UK), 6 Difficult Airway Society, 7 Association of Anaesthetists of Great Britain & Ireland

Table 4 The Obesity Surgery Mortality Risk Stratification score: (a) risk factors; (b) risk of mortality [43].

Risk factor	Score
(a)	
BMI > 50 kg.m^{-2}	1
Male	1
Age > 45 years	1
Hypertension	1
Risk factors for pulmonary embolism:	1
Previous venous thromboembolism	
Vena caval filter	
Hypoventilation (sleep-disordered breathing)	
Pulmonary hypertension	
	Risk of mortality
(b)	
Class A: 0-1 points	0.2–0.3%
Class B: 2–3 points	1.1–1.5%
Class C: 4–5 points	2.4–3.0%

Anesthesiology 2014; 120:268–86

Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea. *An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea*

Table 1. Identification and Assessment of OSA: Example

A. Clinical signs and symptoms suggesting the possibility of OSA

1. Predisposing physical characteristics
   - Adult patients: BMI 35 kg/m^2
   - Pediatric patients: 95th percentile for age and sex
   - Neck circumference 17 inches (men) or 16 inches (women)
   - Craniofacial abnormalities affecting the airway
   - Anatomical nasal obstruction
   - Tonsils nearly touching or touching in the midline
2. History of apparent airway obstruction during sleep

   Two or more of the following are present: (if patient lives alone or sleep is not observed by another person then only one condition needs to be present)
   - Loud snoring (loud enough to be heard through closed door)
   - Frequent snoring
   - Observed pauses in breathing during sleep
   - Awakens from sleep with choking sensation
   - Frequent arousals from sleep
   - Pediatric patients:
     - Intermittent vocalization during sleep
     - Parental report of restless sleep, difficulty breathing, or struggling respiratory efforts during sleep
     - Child with night terrors
     - Child sleeps in unusual positions
     - Child with new onset enuresis
3. Somnolence (one or more of the following is present)
   - Frequent daytime somnolence or fatigue despite adequate "sleep"
   - Falls asleep easily in a nonstimulating environment (*e.g.*, watching television, reading, riding in, or driving a car) despite adequate "sleep"
   - Pediatric patients: parent or teacher comments that child appears sleepy during the day, is easily distracted, is overly aggressive, is irritable, or has difficulty concentrating
   - Pediatric patients: child often difficult to arouse at usual awakening time

If a patient has signs or symptoms in two or more of the above categories, there is a significant probability that he or she has OSA. The severity of OSA may be determined by sleep study (see below). If a sleep study is not available, such patients should be treated as though they have moderate sleep apnea unless one or more of the signs or symptoms above is severely abnormal (*e.g.*, markedly increased BMI or neck circumference, respiratory pauses which are frightening to the observer, patient regularly falls asleep within minutes after being left unstimulated without another explanation) in which case they should be treated as though they have severe sleep apnea.

B. If a sleep study has been done, the results should be used to determine the perioperative anesthetic management of a patient. However, because sleep laboratories differ in their criteria for detecting episodes of apnea and hypopnea, the Task Force believes *that the sleep laboratory's assessment (none, mild, moderate, or severe) should take precedence over the actual AHI. If the overall* severity is not indicated, it may be determined by using the table below:

Severity of OSA	Adult AHI	Pediatric AHI
None	0–5	0
Mild OSA	6–20	1–5
Moderate OSA	21–40	6–10
Severe OSA	>40	>10

AHI = apnea–hypopnea index: the number of episodes of sleep-disordered breathing per hour; BMI = body mass index; OSA = obstructive sleep apnea.

Table 2. Scoring System for Perioperative Risk from OSA: Example*

A. Severity of sleep apnea based on sleep study (or clinical indicators if sleep study is not available)

Point score: (0–3)†‡

Severity of OSA (table 1)	Points
None	0
Mild	1
Moderate	2
Severe	3

B. Invasiveness of surgery and anesthesia

Point score: (0–3)

Type of surgery and anesthesia	Points
Superficial surgery under local or peripheral nerve block anesthesia without sedation	0
Superficial surgery with moderate sedation or general anesthesia	1
Peripheral surgery with spinal or epidural anesthesia (with no more than moderate sedation)	1
Peripheral surgery with general anesthesia	2
Airway surgery with moderate sedation	2
Major surgery, general anesthesia	3
Airway surgery, general anesthesia	3

C. Requirement for postoperative opioids

Point score: (0–3)

Opioid requirement	Points
None	0
Low-dose oral opioids	1
High-dose oral opioids, parenteral or neuraxial opioids	3

D. Estimation of perioperative risk:

Overall point score: the score for A plus the greater of the score for either B or C: (0–6)§

* A scoring system similar to the above may be used to estimate whether a patient is at increased perioperative risk of complications from OSA. This example, which has not been clinically validated, is meant only as a guide, and clinical judgment should be used to assess the risk of an individual patient. † One point may be subtracted if a patient has been on CPAP or NIPPV before surgery and will be using his or her appliance consistently during the postoperative period. ‡ One point should be added if a patient with mild or moderate OSA also has a resting $PaCO_2$ >50 mmHg. § Patients with score of 4 may be at increased perioperative risk from OSA; patients with a score of 5 or 6 may be at significantly increased perioperative risk from OSA.

CPAP = continuous positive airway pressure; NIPPV = noninvasive positive pressure ventilation; OSA = obstructive sleep apnea.

Table 1 Summary of BADS guidance for performing day case surgery on patients with diabetes.

Pre-operative Assessment	1) Type of diabetes – type 1 or type 2 2) Stability of the disease • All patients should have HbA1c ideally <8% • No role for random blood glucose but fasting glucose should be checked 3) Patient's understanding • Home glucose monitoring • Awareness of hypoglycaemia 4) Surgical procedure 5) Type of anaesthesia 6) Assessment of diabetic complications
Peri-operative Management	Guidance includes flowcharts for • Minor Procedures • Intermediate Procedures • Type 2 diabetes treated with oral agents • Type 1 and insulin treated type 2 diabetes In general the principles are 1) Blood glucose <10 mmol/l – proceed with surgery 2) Blood glucose 10–13 mmol/l – assessment and involvement of anaesthetic team; might need GKI infusion 3) Blood glucose >13 mmol/l – check for intercurrent illnesses 4) GKI infusion for all patients on insulin therapy 5) Use of dedicated protocols for all patients with diabetes
Discharge	Advice and support • Patients should be able to measure blood glucose at home • Advice to carry out extra blood tests • Mandatory 24-h helpline should be available

British Association of Day Surgery. Day surgery and the diabetic patient. Working Group 2nd Edition; 2004.

The Royal Society of Medicine

Journal of the Royal Society of Medicine Open;
5(2) 1–6
DOI: 10.1177/2042533313515864

A retrospective review of the assessment of current perioperative management of diabetes in patients undergoing knee replacement surgery

Alan J Howieson[1], Annmarie Brunswicker[1] and Ketan Dhatariya[2]

[1]Department of Orthopaedic Surgery, Norfolk and Norwich University Hospitals, NHS Foundation Trust, Norwich, UK
[2]Diabetes and Endocrinology, Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospitals, NHS Foundation Trust, Norwich, UK
Corresponding author: Ketan Dhatariya. Email: ketan.dhatariya@nnuh.nhs.uk

Table 1. A comparison of our findings, compared to the audit standard goals.

Criteria	Standard	Results
Primary care referrals contain all suggested information	100%	0%
Patients preoperatively assessed	100%	100%
Patients with diabetes management plan	100%	18%
Admitted on day of surgery	90%	100%
Listed first on list	95%	34%
Length of stay	No longer than 10% greater than average	12% greater than average
Patients receive hourly blood glucose monitoring during their procedure, and in recovery	100%	10%
Patients' blood glucose maintained between 4–12 mmol/L	100%	26%
Patients with delayed discharge due to diabetes	0%	0%

These audit standards were set out in the 2011 NHS Diabetes document: Management of adults with diabetes undergoing surgery and elective procedures: improving standards.[3]

3. Dhatariya K, Flanagan D, Hilton L, Kilvert A, Levy N, Rayman G, et al. Management of adults with diabetes undergoing surgery and elective procedures: improving standards. Available from: http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm (last accessed 6 Nov 2013).

Table 2. The minimum amount of information that Ref. 3 suggests should be included in a standardized GP referral letter to a surgical outpatient for a person with diabetes.

- Duration and type of diabetes
- Place of usual diabetes care (primary or secondary)
- Other co-morbidities
- Treatment
  - for diabetes oral agents/insulin doses and frequency
  - for other co-morbidities
- Complications
  - at-risk foot
- Renal impairment
- Cardiac disease
- Relevant measures
  - BMI
  - BP
  - HbA1c result (to be done within the three months prior to referral)
  - eGFR

In England and Wales, all of these data (except the most up to date HbA1c within three months of referral) should be collected either as good clinical practice or part of their Quality and Outcomes Framework (QoF).

Conclusion

Our study has shown, in agreement with previous data, that the perioperative care of patients with diabetes is still suboptimal. Poor long-term glycaemic control is likely to be associated with worse clinical outcomes and, in line with the NHS Diabetes national guideline for the perioperative management of patients with diabetes undergoing surgery, it may be prudent to delay surgery until the preoperative HbA1c is under 69 mmol/mol (8.5%).

Perioperative Management of Patients with Diabetes Undergoing Ambulatory Elective Surgery

Kathryn E. Coan, M.D.,[1] Andrew B. Schlinkert,[1] Brandon R. Beck, B.A.,[1] Danielle J. Haakinson, M.D.,[1] Janna C. Castro, B.S.,[2] Richard T. Schlinkert, M.D.,[2] and Curtiss B. Cook, M.D.[3]

Abstract

Objective:

The objective was to assess processes of care for patients with diabetes undergoing elective surgery.

Methods:

A retrospective review of medical records was conducted to determine frequency of perioperative glucose monitoring, changes in glucose control, and treatment of intraoperative hyperglycemia.

Results:

A total of 268 patients underwent 287 elective procedures. Mean age was 67 years, 63% were men, 97% had type 2 diabetes, and most (57%) were treated with oral hypoglycemic agents. Average perioperative time was approximately 8 h. Mean preoperative hemoglobin A1c was 7.0%; however, this value was checked in only 52% of cases. A glucose measurement was obtained in 89% of cases in the preoperative area and in 87% in the postanesthesia care unit, but in only 33% of cases did a value get checked intraoperatively. Average glucose was 139 mg/dl preoperatively, increasing to 166 mg/dl postoperatively (p <.001). Glucose levels increased regardless of type of outpatient medical therapy used to treat hyperglycemia, except for those on combination oral agents plus insulin (p =.06).

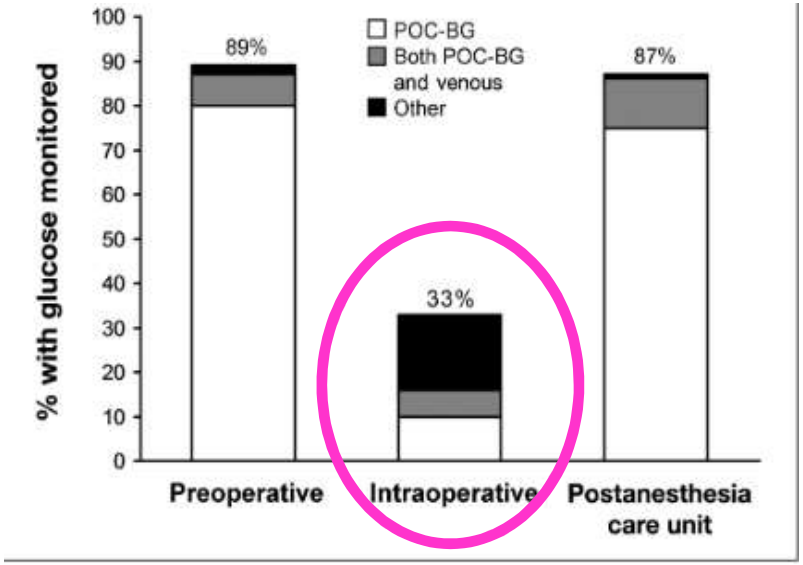
Conclusions:

These data indicate suboptimal documentation of outpatient hemoglobin A1c. Intraoperative glucose monitoring seldom occurred, despite prolonged periods under anesthesia and perioperative deterioration of glycemic control. Standards need to be developed and interventions are needed to enhance management of diabetes patients undergoing elective procedures.

J Diabetes Sci Technol 2013;7(4):983–989

Table 2.
Distribution of 287 Surgical Procedures by Type of Surgical Service

Type of surgical service	Procedures, *n* (%)
Urology	62 (22)
Orthopedic	59 (21)
General	43 (15)
Transplant	29 (10)
Otolaryngology	26 (9)
Vascular	20 (7)
Neurosurgery	13 (4)
Gynecology	12 (4)
Plastics	10 (4)
Colorectal	9 (3)
Cardiothoracic	4 (1)



igure 2. Blood glucose monitoring defined by perioperative phase and ype of monitoring performed. Other denotes a laboratory test other han a point-of-care blood glucose measurement.

Anesthesiology
55:104–109, 1981

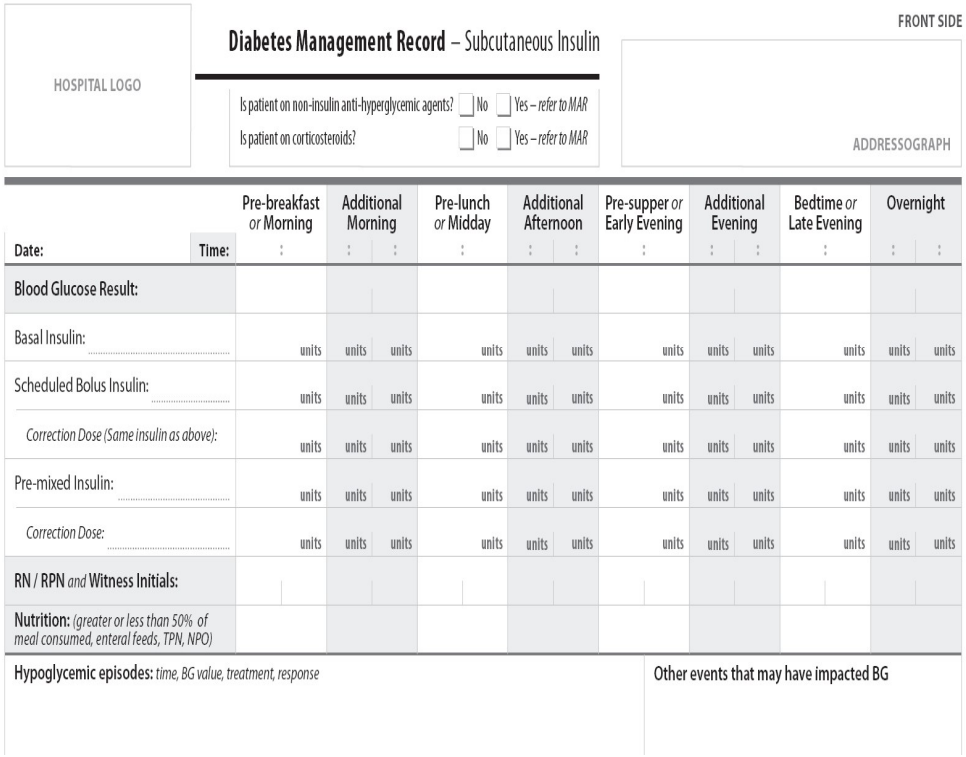
Perioperative Management of Diabetes Mellitus

Leonard F. Walts, M.D., Jordan Miller, M.D.,† Mayer B. Davidson, M.D.,‡ Josiah Brown, M.D.§*

Hourly plasma glucose concentrations in 191 diabetic patients undergoing 200 operations were measured. The glucose infusion rate was controlled. Insulin-taking diabetics given no insulin or a fraction of their usual dose preoperatively developed rising plasma glucose concentrations beginning with the start of operation. The mean rate was 22 $mg \cdot dl^{-1} \cdot h^{-1}$ (no insulin) and 17 $mg \cdot dl^{-1} \cdot h^{-1}$ (one-half to one-fourth the usual dose of insulin). Eight per cent of the patients achieved plasma glucose concentrations greater than 400 mg/dl. Patients given regular insulin during the operation had no hourly rise in plasma glucose. However, hypoglycemia occurred in 5.5 per cent of these patients.

The authors suggest that arbitrary management regimens should be abandoned. Plasma glucose levels should be measured frequently and insulin and/or sugar should be given to each patient as needed. (Key words: Complications: diabetes mellitus. Hormone: insulin. Metabolism: diabetes; glucose; insulin; hyperglycemia; hypoglycemia.)

Appendix 1. Diabetes Management Record SC Insulin



HOSPITAL LOGO

Diabetes Management Record – Subcutaneous Insulin

FRONT SIDE

Is patient on non-insulin anti-hyperglycemic agents? ☐ No ☐ Yes – *refer to MAR*

Is patient on corticosteroids? ☐ No ☐ Yes – *refer to MAR*

ADDRESSOGRAPH

Date: / Time:	Pre-breakfast *or* Morning	Additional Morning	Pre-lunch *or* Midday	Additional Afternoon	Pre-supper *or* Early Evening	Additional Evening	Bedtime *or* Late Evening	Overnight
Blood Glucose Result:								
Basal Insulin:	units	units	units	units	units	units	units	units
Scheduled Bolus Insulin:	units	units	units	units	units	units	units	units
Correction Dose (Same insulin as above):	units	units	units	units	units	units	units	units
Pre-mixed Insulin:	units	units	units	units	units	units	units	units
Correction Dose:	units	units	units	units	units	units	units	units
RN / RPN *and* **Witness Initials:**								
Nutrition: *(greater or less than 50% of meal consumed, enteral feeds, TPN, NPO)*								

Hypoglycemic episodes: *time, BG value, treatment, response*

Other events that may have impacted BG

ismp CANADA

Diabetes Management Record – Subcutaneous Insulin

HOW TO USE THIS FORM

1. Transcribe all intermittent subcutaneous insulin orders on the MAR. This form is **not** intended for intravenous insulin infusions or insulin pumps.
2. Indicate on top of the form if the patient is on oral non-insulin anti-hyperglycemic agents.
3. Indicate on top of the form if the patient is on corticosteroids.
4. Record the time of the blood glucose reading.
5. Record the name of the insulin given.
6. Record the number of units of insulin given in the appropriate box.
7. If patient requires correction dose insulin record the extra number of units given in the designated box.
8. The person who administered the dose should document their initials.
9. If your facility requires an independent double check the "witness" should document their initials beside that of the person who administered the insulin.
10. Indicate the nutritional status of the patient by indicating if greater or less than 50% of the meal has been consumed, if the patient is on parenteral or enteral feeds or if the patient is NPO.
11. If a patient experiences a hypoglycemic episode indicate the time it happened, the BG reading, the treatment that was given to correct it, the patient's response to the treatment and any other factors that may have contributed to the episode.
12. Document if any additional factors occurred to cause the BG to deviate from the normal range (e.g., starting corticosteroids).

Can J Diabetes 38 (2014) 101e117

Perioperative Management of Diabetic Patients Undergoing Hand Surgery

Jason R. Kang, MD, Jeffrey Yao, MD

CME Continuing Medical Education

TABLE 1. Oral Hypoglycemic Agents

Medication	Recommended Dosing Morning of Surgery	Comments
Biguanides Metformin (Glucophage; Bristol-Myers Squibb, New York, NY)	Hold 48 h before surgery[11]	Avoid lactic acidosis
Thiazolidinedione Rosiglitazone (Avandia; GlaxoSmithKline, Philadelphia, PA) Pioglitazone (Actos; Takeda Pharmaceuticals, Deerfield, IL)	Hold dose[10]	
Sulfonylureas Glyburide (Diabeta [Sanofi, Bridgewater, NJ], Micronase [Pfizer, New York, NY]) Glipizide (Glucotrol; Pfizer) Glimepiride (Amaryl; Sanofi)	Hold 24 h before surgery[8]	Avoid hypoglycemia and adverse cardiac effects
Meglitinides Repaglinide (Prandin; Novo Nordisk, Plainsboro, NJ) Nateglinide (Starlix; Novartis, New York, NY)	Hold dose[8]	
Gliptins Sitagliptin (Januvia; Merck, Whitehouse Station, NJ) Vildagliptin Saxagliptin	Hold dose[10]	
α-Glucosidase inhibitors Acarbose (Precose; Bayer Healthcare Pharmaceuticals, Whippany, NJ) Miglitol	Hold dose[10]	

TABLE 2. Insulin

Medication	Recommended Dosing Morning of Surgery
Short/rapid-acting insulin Lispro (Humalog; Eli Lilly, Indianapolis, IN) Aspart (Novolog; Novo Nordisk) Regular (Novolog R [Novo Nordisk], Humulin R [Eli Lilly])	Hold dose[10]
Intermediate-acting insulin NPH (Novolin N [Novo Nordisk], Humulin N-NF [Eli Lilly])	50% to 75% dose[10]
Long-acting insulin Glargine (Lantus; Sanofi) Detemir (Levemir; Novo Nordisk)	75% to 100% dose[10]
Premixed (intermediate and rapid acting) insulin	50% to 75% dose[10]
Insulin pump	No change, continue basal rate[10]

Adapted with permission from Joshi G, Chung F, Vann M, et al. Society for Ambulatory Anesthesia consensus statement on perioperative blood glucose management in diabetic patients undergoing ambulatory surgery. *Anesth Analg*. 2010;111(6):1378–1387.

J Hand Surg Am. r Vol. 40, May 2015

Table 1
Inpatient glucose target recommendations by organizations

Organization	Inpatient Glucose Target (mg/dL)
American Association of Clinical Endocrinologists and American Diabetes Association Consensus Statement on Inpatient Glycemic Control[29]	140–180
American College of Physicians[46]	140–200
Society of Thoracic Surgeons[47]	For critically ill patients, <180 in the peak prandial state If patient in ICU >3 d then <150 is recommended For step-down or floor patients, <180 or ≤110 in the premeal or fasting state
Critical Care Medicine[48–51]	Target therapy for <150 for most ICU patients at all times ≥150 should trigger initiation of insulin therapy

46. Qaseem A, Chou R, Humphrey LL, et al. Inpatient glycemic control: best practice advice from the Clinical Guidelines Committee of the American College of Physicians. Am J Med Qual 2014;29(2):95–8. **47**. Lazar HL, McDonnell M, Chipkin SR, et al. The Society of Thoracic Surgeons practice guideline series: Blood glucose management during adult cardiac surgery. Ann Thorac Surg 2009;87(2):663–9. **48**. Jacobi J, Bircher N, Krinsley J, et al. Guidelines for the use of an insulin infusion for the management of hyperglycemia in critically ill patients. Crit Care Med 2012;40(12):3251–76.

29. Moghissi ES, Korytkowski MT, DiNardo M, et al. American Association of ClinicalEndocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. Diabetes Care 2009;32(6):1119–31.

51. Halkos ME, Lattouf OM, Puskas JD, et al. Elevated preoperative hemoglobin A1c level is associated with reduced long-term survival after coronary artery bypass surgery. Ann Thorac Surg 2008;86(5):1431–7.

Patient selection for day surgery

Leanne Darwin

Abstract

Day surgery is a planned pathway delivered by a multidisciplinary team and is perhaps better described as 'same day surgery'. In 2000 the NHS set a target of performing 75% of operations as same day surgery but practice varies widely; an assessment of 10 procedures easily performed as same day surgery showed rates varying from 19% to 90% by procedure and the potential day case rate was not being reached for any procedure. There is a move to 'treat day surgery as the norm' in an effort to increase rates of day surgery so this article describes patient selection and procedures for day surgery, and discusses techniques which can be employed by anaesthetists and surgeons to achieve the reduced surgical trauma, rapid recovery and minimal complications necessary for successful day surgery.

Keywords Anaesthetic technique; day surgery; patient selection; regional anaesthesia; same day surgery; short stay surgery

Royal College of Anaesthetists CPD Matrix: 3A06

ANAESTHESIA AND INTENSIVE CARE MEDICINE
17:3 2015

possible after surgery. The Society for Ambulatory Anaesthesia (SAMBA) has issued a consensus statement on the perioperative management of diabetic patients undergoing day surgery.

Diabetic patients require specific preoperative assessment because:

- type 1 diabetic patients are more liable to unplanned admission than type 2 diabetics
- diabetic stability in the months preceding surgery is key to successful day surgery, particularly in type 1 diabetes
- random blood glucose measurements are not useful in assessing preoperative diabetic stability
- useful indicators of diabetic stability are haemoglobin A_{1C} (HbA_{1C}) estimations, blood glucose profiles over preceding months, emergency admissions, hypoglycaemic attacks and medication changes
- there are insufficient data to recommend a fasting blood glucose or HbA_{1C} above which day surgery should not proceed, but if there are complications of hyperglycaemia such as severe dehydration, ketoacidosis or hyperosmolar non-ketotic states, surgery should be postponed
- patients and carers should have a good understanding of diabetes and its management.

Guidelines for perioperative management advise that:

- Hypoglycaemic medication other than long-acting insulins should be omitted on the morning of surgery; the return to usual medication and diet should occur as soon as possible after surgery. Metformin does not need to be withheld although it often is owing to concerns about the development of lactic acidosis should renal function deteriorate after surgery.
- Patients must bring their usual medication with them, and a sugary drink in case of preoperative hypoglycaemia.
- Patients should be scheduled as early as possible, preferably first on a list, but if they are likely to require perioperative insulin being second on the list reduces delays.
- The optimal blood glucose for day surgery is unknown. There is no evidence that any particular blood glucose is beneficial or harmful for patients undergoing day surgery so the target perioperative blood glucose level should depend upon the type and duration of surgery and anaesthetic technique.
- If the decision is made to proceed with surgery in patients with poorly controlled diabetes, target blood glucose levels should be around their preoperative baseline values.
- Dexamethasone 4 mg can be used for prevention of PONV in diabetics, but modification of hypoglycaemic therapy may be required.
- Vigilance for perioperative hypoglycaemia is essential.
- Patients should be warned of the possibility of delayed hyperglycaemia or hypoglycaemia before discharge.

Table 3
Day-of-surgery insulin dosing

Regimen	Dosing for Early Case	Dose Adjustment for Later Case	During Case in OR	Dosing in PACU
Basal insulins (in physiologic regimens)				
Insulin pump	Maintain basal rate or decrease by 20%–30% if patient reports hypoglycemia	Maintain basal rate or decrease by 20%–30%	Maintain basal or decreased rate in OR if possible	Maintain basal rate if possible Bolus with food
Peakless single or bid dosing (eg, glargine, detemir)	Give usual morning dose or decrease by 20%–30% if patient reports hypoglycemia	Give usual morning dose or decrease by 20%–30%	Not appropriate	Not appropriate
Intermediate insulins or peakless nonbasal dosing[a]				
Peakless single or bid dosing (sole insulin[a]) (eg, glargine, detemir)	Options: give full dose prior to minor case; hold full dose until after case; give % of dose	Give % of dose based on *expected* time to first meal	Not appropriate	Give if held: full dose or calculated % of insulin
Intermediate-acting insulin: single or bid dosing (eg, NPH insulin)	Options: same as above	Give same as above	Not appropriate	Give if held: full-dose or calculated % of insulin
Premixed or fixed combination of long- and short-acting insulins (eg, 70/30)	Options: hold morning dose; give full or calculated amount of long-acting insulin (70%) only	Give calculated amount of long-acting insulin (70%) only	Not appropriate	Give if held: full-dose or calculated amount of insulin (long acting or combination)
Nutritional or correction dose insulin (RAISs recommended)	Give: as needed for hyperglycemia: use rule of 1800/1500 or patient's usual correction factor	Give: as needed for hyperglycemia: use rule of 1800/1500 or patient's usual correction factor	Give: as needed for hyperglycemia: use rule of 1800/1500 or patient's usual correction factor	Give: as needed for hyperglycemia or when food intake resumes: use rule of 1800/1500 or patient's usual correction factor

Abbreviations: OR, operating room; PACU, postanesthesia care unit.
[a] Peakless insulin as a sole insulin is not considered basal dosing.

Anesthesiology Clin 32 (2014) 329–339

Box 1
Day-of-surgery adjustment of single peakless or intermediate-acting insulins (eg, glargine as sole agent, NPH insulin, or premixed insulins)

This formula uses the predicted or actual time of fasting and the usual time interval between doses of insulin:

$$\frac{[\text{Dosing interval (h)} - \text{Hours of fast during interval}]}{\text{Dosing interval (h)}} = \text{fraction of insulin to give}$$

Examples

Case: adult patient undergoing carpal tunnel release under block with sedation. He is estimated to be eating normally by 10:00 AM due to this minimally disruptive anesthesia technique.

A. If this patient usually takes 1 dose of 32 U of glargine at 7:00 AM daily (dosing interval is 24 hours, time of fast *predicted* as 3 hours), (24 – 3)/24 = 21/24, he would receive seven-eighths of his morning dose or 28 U (give before or after case).

B. If patient in scenario A is in the PACU, his morning insulin was held and his case is done in 1 hour, so he *actually* only misses 2 hours of food intake: (24 – 2)/24 = 11/12, he would essentially receive his usual dose, or 30–32 U of glargine, in the PACU.

C. If this patient usually takes 24 U of glargine twice daily at 7:00 AM and 7:00 PM (dosing interval is 12 hours) and he is *predicted* to eat at 10 AM, (12 – 3)/12 = 9/12, he would receive three-quarters of his usual morning dose or 18 U (give before or after case).

D. Patient (same scenario as C) usually takes 50 U of premixed NPH insulin/regular insulin 70/30 twice a day. His NPH insulin dose is only 35 U twice daily and this is the amount of insulin that should be used in calculation. He would receive three-quarters of the 35 U or 27 U of NPH insulin only (*not the mix*).

E. Patient (same scenario as C) is scheduled later in the day and is expected to eat at 1:00 PM. He is expected to miss 6 hours of food intake. He has not taken morning insulin: (12 – 6)/12 = 6/12, he would receive one-half his usual morning dose or 12 U, which should be given prior to surgery to supplement endogenous insulin. His BG, however, should be checked frequently until he is eating normally.

From Vann MA. Perioperative management of ambulatory surgical patients with diabetes mellitus. Curr Opin Anaesthesiol 2009;22(6):718–24; with permission.

Management of Diabetes Medications for Patients Undergoing Ambulatory Surgery

Mary Ann Vann, MD

KEYWORDS

- Ambulatory anesthesia • Ambulatory surgery • Diabetes mellitus
- Perioperative hyperglycemia • Perioperative insulin

KEY POINTS

- Perioperative hyperglycemia is typically due to the neuroendocrine stress response and the discontinuation of insulin and other antihyperglycemic medications.
- Blood glucose (BG) should be maintained in a patient's usual range because acute variations may be harmful.
- Hypoglycemia treatments should be readily available for fasting patients.
- For type 1 diabetic patients, basal insulins should be administered at or near customary doses.
- For type 2 diabetic patients, oral medications may be withheld on the day of surgery until meals resume; intermediate-acting or sole peakless insulin regimens usually require modification.

PREOPERATIVE INQUIRIES

Patients should be questioned about duration and type of diabetes, compliance with medications, level of glycemic control, and frequency of self-monitoring of BG (SMBG). Their understanding of and skill in managing their treatment regimen must be evaluated prior to altering medications preoperatively. Practitioners should ascertain the incidence and frequency of hypoglycemia, the BG at which symptoms occur, and the presence of hypoglycemia unawareness.

Medications for Type 2 Diabetes Mellitus

Among diabetics, 72% take oral hypoglycemic drugs,[1] with metformin the first-line oral hypoglycemic. Patients with renal insufficiency may develop lactic acidosis, and metformin is often held prior to radiologic procedures requiring contrast. Insulin secretagogue

The author has no interests to disclose.
Department of Anesthesia, Critical Care and Pain Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, 330 Brookline Avenue, Boston, MA 02215, USA
E-mail address: mvann@bidmc.harvard.edu

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1932-2275/14/$ – see front matter

Box 4

Factors that may affect perioperative POC capillary BG measurements

Hypoglycemia

Oxygen administration

Acetaminophen

Hypotension, use of vasopressors

Anemia

pH changes

Active warming or cooling

Vitamin C excess

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E-mail address: mvann@bidmc.harvard.edu

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1932-2275/14/$ – see front matter

American Diabetes Association's glycemic targets in hospitalized patients

Critically ill patients

- Initiate insulin therapy for persistent hyperglycemia greater than 180 mg/dL to maintain a goal glucose of 140 to 180 mg/dL.
- Consider tighter targets if clinically appropriate and safe to do so.
- Consider use of institutional intravenous insulin drip protocol.

Noncritically ill patients

- Use preprandial goal glucose less than 140 mg/dL with random glucose less than 180 mg/dL.
- Consider tighter targets if clinically appropriate and safe to do so.

Medication choice

- Use of oral diabetes agents in hospitalized patients is not recommended for most clinical settings.
- Insulin protocols should account for carbohydrate intake; sole use of sliding-scale correction insulin is discouraged.

Modified from American Diabetes Association. Diabetes care in the hospital, nursing home, and skilled nursing facility. Sec. 13. In standards of medical care in diabetes. Diabetes Care 2015;38(Suppl 1):S80–5.

Journal of Diabetes Science and Technology
Volume 6, Issue 5, September 2012

SYMPOSIUM

Insulin Pump Therapy in the Perioperative Period: A Review of Care after Implementation of Institutional Guidelines

Mary E. Boyle, C.N.P.,[1] Karen M. Seifert, M.S.N.,[2] Karen A. Beer, P.A.,[1] Patricia Mackey, C.N.P.,[1] Richard T. Schlinkert, M.D.,[3] Joshua D. Stearns, M.D.,[4] and Curtiss B. Cook, M.D.[1]

Conclusions:

Although some processes still require improvement, preliminary data suggest that the policy for perioperative management of insulin pumps has provided useful structure for care of these cases. The data thus far indicate that insulin pump therapy can be continued safely during the perioperative period.

Assessment is needed on how well these steps might work in other types of institutions (e.g., community hospitals). Ongoing data collection and analysis continue as we strive to develop consensus guidelines for insulin pump patients in the surgical arena.

Journal of Diabetes Science and Technology
Volume 6, Issue 1, January 2012

CLINICAL APPLICATION

Guidelines for Application of Continuous Subcutaneous Insulin Infusion (Insulin Pump) Therapy in the Perioperative Period

Mary E. Boyle, C.N.P., C.D.E.,[1] Karen M. Seifert, M.S.N., C.D.E.,[2] Karen A. Beer, P.A., C.D.E.,[1] Heidi A. Apsey, N.P.,[3] Adrienne A. Nassar, M.D.,[4] Stephanie D. Littman, R.N.,[5] Janice M. Magallanez, R.N.,[5] Richard T. Schlinkert, M.D.,[3] Joshua D. Stearns, M.D.,[6] Michael J. Hovan, M.D.,[7] and Curtiss B. Cook, M.D.[1]

Sample Perioperative Insulin Pump Checklist

Preoperative
1. Insulin pump connected? Y N
   a. Location of pump?_____ Outside of surgical scrub area? Y N
   b. Current basal rate (per patient) _____
   c. Anesthesiologist notified? Y N
      1) Leave pump on during surgery? Y N
      2) If pump will be off, what is the alternative insulin regimen? _____
2. POC blood glucose measurements
   a. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____
   b. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____

Intraoperative
1. Insulin pump connected? Y N
   a. If not connected, what is the alternative insulin regimen? _____
      1) Insulin drip? Y N Rate?_____ Time?_____
      2) Regular insulin boluses? Y N
   b. If connected, location of pump? _____ Infusion rate? _____
2. POC blood glucose measurements
   a. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____
   b. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____
   c. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____
   d. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____
3. Pump complications during surgery? Y N Explain (if yes) _____
4. If insulin drip used, was rate changed during surgery? Y N
   a. Rate_____ Time_____
   b. Rate_____ Time_____

Postanesthesia
1. Insulin pump connected? Y N
   a. Location of pump?_____
   b. Infusion rate? _____
2. POC blood glucose measurements
   a. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____
   b. $Glucose_{POC}$ = _____ Time_____ Insulin given? Type_____ Amount _____

Figure 1. Sample Perioperative Insulin Pump Checklist. N, no; POC, point-of-care; Y, yes.

Randomized Study of Basal-Bolus Insulin Therapy in the Inpatient Management of Patients With Type 2 Diabetes Undergoing General Surgery (RABBIT 2 Surgery)

GUILLERMO E. UMPIERREZ, MD[1,2]
DAWN SMILEY, MD[1,2]
SOL JACOBS, MD[1,3]
LIMIN PENG, PHD[4]
ANGEL TEMPONI, MD[1,2]
PATRICK MULLIGAN, BA[1,3]
DENISE UMPIERREZ, BA[1,2]
CHRISTOPHER NEWTON, MD[1,2]
DARIN OLSON, MD, PHD[1,5]
MONICA RIZZO, MD[6]

Table 2—*Composite hospital complications and outcomes composite hospital complications*

	All	SSI	Basal-bolus insulin	P value
Wound infections	14	11	3	0.050
Pneumonia	3	3	0	0.247
Acute respiratory failure	6	5	1	0.213
Acute renal failure	15	11	4	0.106
Bacteremia	3	2	1	0.999
Number of patients with complications	35	26	9	0.003
Mortality	2	1	1	NS
Postsurgery ICU admission (%)	16	19.6	12.5	NS
Length of stay (days)				
ICU	2.51 ± 1.90	3.19 ± 2.14	1.23 ± 0.60	0.003
Hospital	6.8 ± 8.9	6.3 ± 5.6	7.23 ± 11.39	NS

Table 3—*Hypoglycemic events*

Variable	All	SSI	Basal-bolus insulin	P value
Number of patients	211	107	104	
Number of BG tests	3,778	1,826	1,952	
BG <40 mg/dL				
Number of patients (%)	4 (3.8)	0 (0)	4 (3.8)	0.057
Number of events	4	0	4	
Number of readings (%)	0.10	0	0.20	
BG <60 mg/dL				
Number of patients (%)	14 (6.6)	2 (1.9)	12 (11.5)	0.005
Number of events	17	2	15	
Number of readings (%)	0.45	0.11	0.77	
BG <70 mg/dL				
Number of patients (%)	29 (0.8)	5 (4.7)	24 (23)	<0.001
Number of events	44	6	38	
Number of readings (%)	1.16	0.33	1.95	

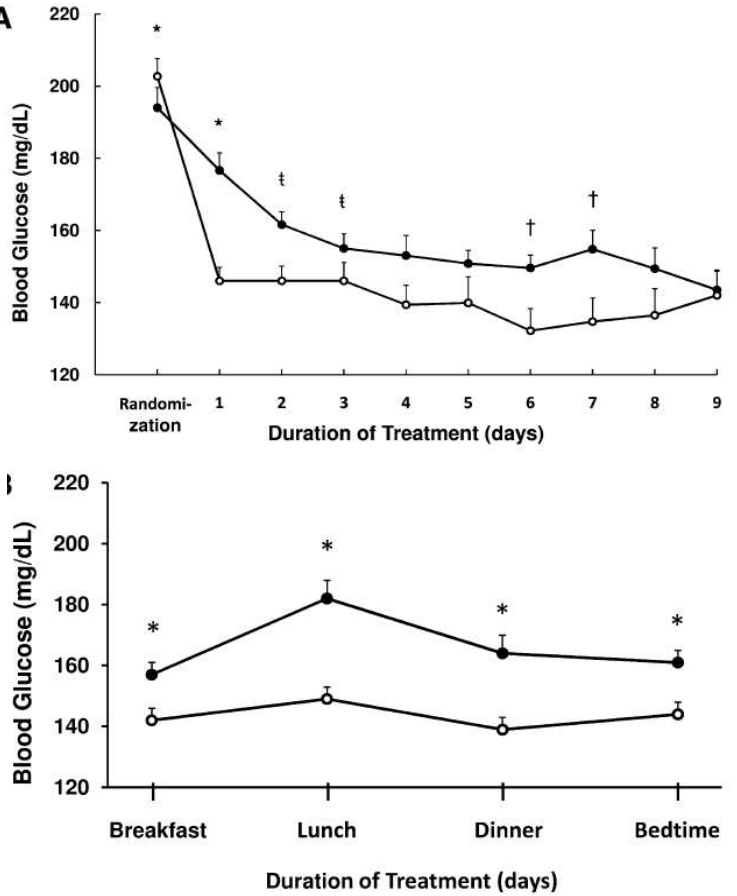


Figure 1—A: *Glucose levels during basal-bolus and SSI treatment. Changes in blood glucose concentration after the 1st day of treatment with basal-bolus with glargine once daily plus glulisine before meals (○) and with SSI 4-times daily (●). *P < 0.001, ‡P = 0.02, †P = 0.01. B: Glucose levels before meals and bedtime. Premeal and bedtime glucose levels were higher throughout the day in the SSI group (●) compared with basal-bolus regimen (○).*

CONCLUSIONS—Basal-bolus treatment with glargine once daily plus glulisine before meals improved glycemic control and reduced hospital complications compared with SSI in general surgery patients. Our study indicates that a basal-bolus insulin regimen is preferred over SSI in the hospital management of general surgery patients with type 2 diabetes.

Diabetes Care 34:256–261, 2011

ORIGINAL ARTICLE

Randomized Study Comparing a Basal-Bolus With a Basal Plus Correction Insulin Regimen for the Hospital Management of Medical and Surgical Patients With Type 2 Diabetes

Basal Plus Trial

GUILLERMO E. UMPIERREZ, MD[1]
DAWN SMILEY, MD[1]
KATHIE HERMAYER, MD[2]
AMNA KHAN, MD[3]
DARIN E. OLSON, MD, PHD[1,4]
CHRISTOPHER NEWTON, MD[1]
SOL JACOBS, MD[1]
MONICA RIZZO, MD[5]
LIMIN PENG, PHD[6]
DAVID REYES, MD[1]
INGRID PINZON, MD[1]
MARIA EUGENIA FEREIRA, MD[1]
VICKY HUNT, BA[2]
ASHWINI GORE, MD[2]
MARCOS T. TOYOSHIMA, MD[1]
VIVIAN A. FONSECA, MD[3]

OBJECTIVE—Effective and easily implemented insulin regimens are needed to facilitate hospital glycemic control in general medical and surgical patients with type 2 diabetes (T2D).

RESEARCH DESIGN AND METHODS—This multicenter trial randomized 375 patients with T2D treated with diet, oral antidiabetic agents, or low-dose insulin (≤0.4 units/kg/day) to receive a basal-bolus regimen with glargine once daily and glulisine before meals, a basal plus regimen with glargine once daily and supplemental doses of glulisine, and sliding scale regular insulin (SSI).

RESULTS—Improvement in mean daily blood glucose (BG) after the first day of therapy was similar between basal-bolus and basal plus groups ($P = 0.16$), and both regimens resulted in a lower mean daily BG than did SSI ($P = 0.04$). In addition, treatment with basal-bolus and basal plus regimens resulted in less treatment failure (defined as >2 consecutive BG >240 mg/dL or a mean daily BG >240 mg/dL) than did treatment with SSI (0 vs. 2 vs. 19%, respectively; $P < 0.001$). A BG <70 mg/dL occurred in 16% of patients in the basal-bolus group, 13% in the basal plus group, and 3% in the SSI group ($P = 0.02$). There was no difference among the groups in the frequency of severe hypoglycemia (<40 mg/dL; $P = 0.76$).

CONCLUSIONS—The use of a basal plus regimen with glargine once daily plus corrective doses with glulisine insulin before meals resulted in glycemic control similar to a standard basal-bolus regimen. The basal plus approach is an effective alternative to the use of a basal-bolus regimen in general medical and surgical patients with T2D.

Diabetes Care 36:2169–2174, 2013

critically ill patients have reported that improvement of glycemic control reduces hospital complications (4–6), hospital stay, and mortality (6–8). In patients with T2D admitted to general medicine and surgery services, recent randomized, controlled trials have shown that treatment with a basal-bolus regimen results in significantly lower mean daily blood glucose (BG) and in a higher percentage of BG within target range than does treatment with sliding scale regular insulin (SSI) (9,10). In addition, in general surgical patients, the basal-bolus approach results in a significant reduction in the frequency of composite complications, consisting of postoperative wound infection, pneumonia, bacteremia, and acute renal and respiratory failure (10). On the basis of these results, clinical practice guidelines have recommended the use of the basal-bolus approach as the preferred insulin regimen for the management of patients with diabetes not in the intensive care unit (ICU) (11–13).

Despite the benefits of a basal-bolus regimen in improving glycemic control in non-critically ill patients (2,7,9,10,14), many health care providers and hospitalists are reluctant to integrate this ap-

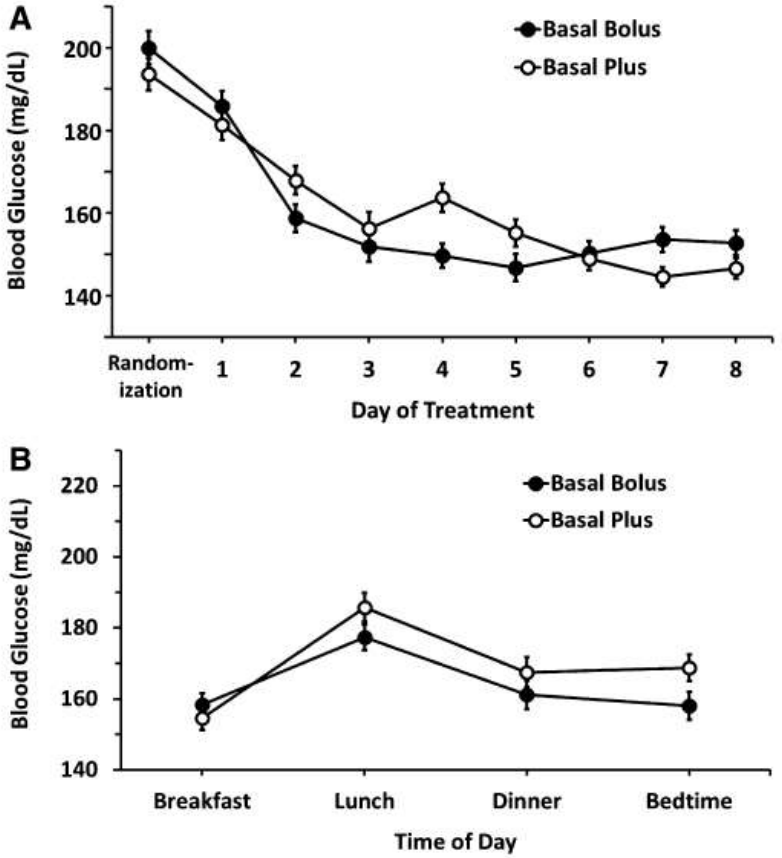


Figure 1—*Differences in glycemic control in medical and surgical patients with T2D treated with basal-bolus (●) and basal plus (○) regimens. A: Mean daily BG levels. B: Mean BG levels before meals and bedtime.*

Table 1. Side Effects and Safety Considerations for Antihyperglycemic Agents

Antihyperglycemic Agent	Risk of Hypoglycemia?	Effect on Weight	Common Side Effects	Less Frequent Side Effects	Contraindications/ Precautions
Metformin/biguanides	No	Mild decrease to none	Gastrointestinal upset	Lactic acidosis, vitamin B12 deficiency	Renal failure (serum creatinine > 1.5 mg/dl in males and 1.4 in females), decreased creatinine clearance, hepatic failure (especially with alcohol abuse), metabolic acidosis
TZDs 1. Pioglitazone 2. Rosiglitazone	No	Increase	Edema, anemia	Fracture risk; rosiglitazone: myocardial infarction; pioglitazone: bladder cancer	Hepatocellular disease, alanine aminotransferase > 2.5 times the upper limit of normal, New York Heart Association class III or IV heart failure
Sulfonylurea complex drugs 1. SUs a. 1st generation agents b. Glyburide c. Glipizide d. Gliclazide e. Glimepiride 2. Meglitinides 3. Nateglinide	 Yes Yes Yes	 Increase Increase Increase		 Cardiotoxicity; disulfiram-like reaction with alcohol; hyponatremia, jaundice	
α-Glucosidase inhibitors 1. Acarbose 2. Miglitol	No	Decrease	Flatulence	Acarbose: hepatotoxicity, anemia	Intestinal disease; acarbose: liver cirrhosis; miglitol: renal failure
GLP-1 receptor agonists 1. Exenatide 2. Liraglutide	No	Decrease	Gastrointestinal upset	Pancreatitis; exenatide: renal failure; liraglutide: MTC	History of pancreatitis and presence of severe hypertriglyceridemia, renal failure (estimated glomerular filtration rate < 30 ml/min/1.73 m2); liraglutide: multiple endocrine neoplasia type 2, personal/family history of MTC
DPP-4 inhibitors 1. Sitagliptin 2. Saxagliptin 3. Vildagliptin	No	Neutral	Predisposition to nasopharyngitis or UTI; saxagliptin: headache, UTI; vildagliptin: headache, dizziness	Pancreatitis; sitagliptin: slight neutrophilia, allergic reactions; saxagliptin: hypersensitivity; vildagliptin: hepatic dysfunction	History of pancreatitis
Pramlintide	Yes	Initial decrease	Gastrointestinal upset		Gastroparesis
SGLT-2 inhibitors	No	Neutral	UTI and genital mycotic infections		Renal failure
Colesevelam	No	Neutral	Gastrointestinal upset		History of bowel obstruction, triglyceride-induced pancreatitis, or triglyceride level > 500 mg/dl
Bromocriptine	No	Decrease	Gastrointestinal upset		History of syncopal migraines or severe hypotension
Insulin	Yes	Increase		Chronic skin reaction: lipodystrophy	

MTC, medullary thyroid cancer; UTI, urinary tract infection.

WHY SPECIAL CONCERNS ?

- Hypo and hyperglycemia.
- Multiple co-morbidities including microvascular and macrovascular complications.
- Complex polypharmacy , including misuse of Insulin.
- Inappropriate use of intravenous insulin infusion.
- Management errors when converting from the intravenous insulin infusion to usual medication.
- Peri-operative infection.

PRE-OPERATIVE EVALUATION

- Determine the type of diabetes and its management.
- Ensure that the patient's diabetes is well controlled.
- Review of medications.
- 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.
- Identify high-risk patients requiring critical care management.

PERIOPERATIVE DIABETES MANAGEMENT GUIDELINES-AUSTRALIAN DIABETES SOCIETY MAY 2011

GENERAL PRINCIPLES

- Diabetes should be well controlled prior to elective surgery.
- Avoid insulin deficiency, and anticipate increased insulin requirements.
- The patient's diabetes care provider should be involved in the management of their patient's diabetes peri-operatively.
- Patients must be given clear written instructions concerning the management of their diabetes both pre- and post-operatively (including medication adjustments) prior to surgery.

CONTD...

- Patients must not drive themselves to the hospital on the day of the procedure.
- Patients with diabetes should be on the morning list, preferably first on the list.
- These guidelines may need to be individually modified depending on the patient's circumstance.
- Patients should be well hydrated before the procedure.

GOALS

- To maintain glycaemic control.
- To prevent further deterioration of pre-existing end organ damage and minimise the metabolic consequence of starvation and surgical stress.
- To shift patient soon on pre-operative glycaemic control drugs and prevention of PONV.
- To prevent complication.
- Greater concern for aseptic precaution.
- Postoperative pain management.

PERIOPERATIVE DIABETES MANAGEMENT GUIDELINES-AUSTRALIAN DIABETES SOCIETY MAY 2011

GLYCEMIC CONTROL

CONTD…

- Postpone elective surgery if possible if glycaemic control is poor (HbA1c ≥ 9%).
- For major surgery, if serum glucose is >270 mg/dl preoperatively, surgery should be delayed while rapid control is achieved with IV insulin.
- If serum glucose is >400 mg/dl , the surgery should pe postponed and metabolic state restabilized.
- BGL should be kept between 5 – 10mmol/l (90-180mg/dl) during the perioperative period .
- For critically ill patients who require admission to the intensive care unit post-operatively, a "tighter" BGL target (e.g 4.4-6.1 mmol/L) may not convey any greater benefit.
- Hypoglycemia must be avoided.
- All patients with diabetes treated with insulin should be managed in the same way, irrespective of whether they have type 1 or type 2 diabetes mellitus.

PERIOPERATIVE DIABETES MANAGEMENT GUIDELINES-AUSTRALIAN DIABETES SOCIETY MAY 2011

CONTD…

- Insulin management dependent on
  - Pre-op glycemic control
  - Insulin regimen
  - Magnitude of surgery
  - Timing and duration of surgery
  - Resumption of patients usual diet.

- Minor surgery is defined as all day-only procedures, while major surgery includes all procedures that require at least an overnight admission*

PERIOPERATIVE DIABETES MANAGEMENT GUIDELINES-AUSTRALIAN DIABETES SOCIETY MAY 2011

PATIENTS WHO REQUIRE INSULIN THERAPY

- This group includes patients with type 1 diabetes or patients with type 2 diabetes who require day time insulin injections.
- Patients who take both evening and morning doses of insulin should take their usual dose of evening short-acting insulin, but reduce their intermediate- or long-acting dose by 20% the night before surgery.
- On the morning of surgery, they should omit their short-acting insulin and reduce the intermediate- or long-acting dose by 50% (and take this only if the fasting glucose is >120 mg/dl)
- Premixed insulin → reduce their evening dose prior surgery by 20% and hold insulin completely on the morning of procedure.
- Some patients receiving insulin may also take oral AHG.

PRE -OP

- Night before surgery- two thirds of total night dose
- Morning of sugery - NPH/2 of usual dose and full dose of regular Insulin
- Start 5%D with 0.45% of NS i.v at 1.5 ml/kg/hr (100ml/hr)
- If infusion is going on – BG/150 U iv and D5W @ 1 ml/kg/hr

PRE -OP

- If patient is on Insulin pump
  - Over night rate- 70% of basal rate
  - Morning-
    - continue same rate as usual
    - Stop continuous Insulin infusion
    - s/c Glargine and discontinue pump in 60 to 90 min

PRE -OP

- If patient is on Glargine and aspart
  - Night
    - 2/3rd of Glargine
    - Entire aspart/lispro
  - Morning
    - Stop all

PRE-OP

- If patient is on OHA
  - Stop Sulfonylureas
    - It blocks myocardial K-ATP channel and inhibit ischemic preconditioning , a cardioprotective mechanism.
    - So it should be stopped 24 to 48 hrs prior to surgery.

PRE-OP

- If for minor surgery and well controlled DM -2 – no need of Insulin
- If poorly controlled type 2 DM, all type I minor surg and major surg- needs Insulin
- Major surg with
  - BG >270mg/dl –delay surgery with rapid control
  - If 400 mg/dl – surgery postponed and metabolic state reestablished.

PATIENTS UNDERGOING MINOR SURGERY:

- **Type 1 diabetes**
- First on morning list.
- Insulin adjustments
- If blood glucose is 12 mmol/litre (200mg/dl) or more start Insulin/dextrose/potassium regimen.
- Take blood glucose measurements 1 hour preoperatively, hourly intraoperatively, and 2 hourly postoperatively until the patient is eating and drinking.
- The normal Insulin regimen can be given once the patient is eating and drinking.

MINOR SURGERY

- **Type 2 diabetes**
- Omit oral hypoglycaemic on morning of surgery except metformin, omitted much before.
- Measure blood glucose as above.
- Restart oral hypoglycaemics with first meal.

PATIENTS UNDERGOING MAJOR SURGERY:

- Major surgery is that not falling into the above category and emergency surgery. Type 1 and type 2 diabetes are treated the same.

- Insulin managment

- Start Insulin/dextrose/potassium regimen according to blood glucose.

- Measure blood glucose 2 hourly during infusion and hourly during surgery.

- **Classic "Non-Tight Control" Regimen**

Aim:

- To prevent hypoglycemia, ketoacidosis, and hyperosmolar states.

protocol:

- 1. On the day before surgery, the patient should be kept NPO after midnight.
- 2. At 6 AM on the day of surgery, infuse a solution of IV fluids containing 5% dextrose at a rate of 125 mL/hr/70 kg body weight.
- 3. After starting the IV infusion, give half the usual morning Insulin dose (and the usual type of Insulin) subcutaneously.
- 4. Continue 5% dextrose solutions through the operative period and give at least 125 mL/hr/70kg body weight.
- 5. In the recovery room, monitor blood glucose concentrations and treat on a sliding scale

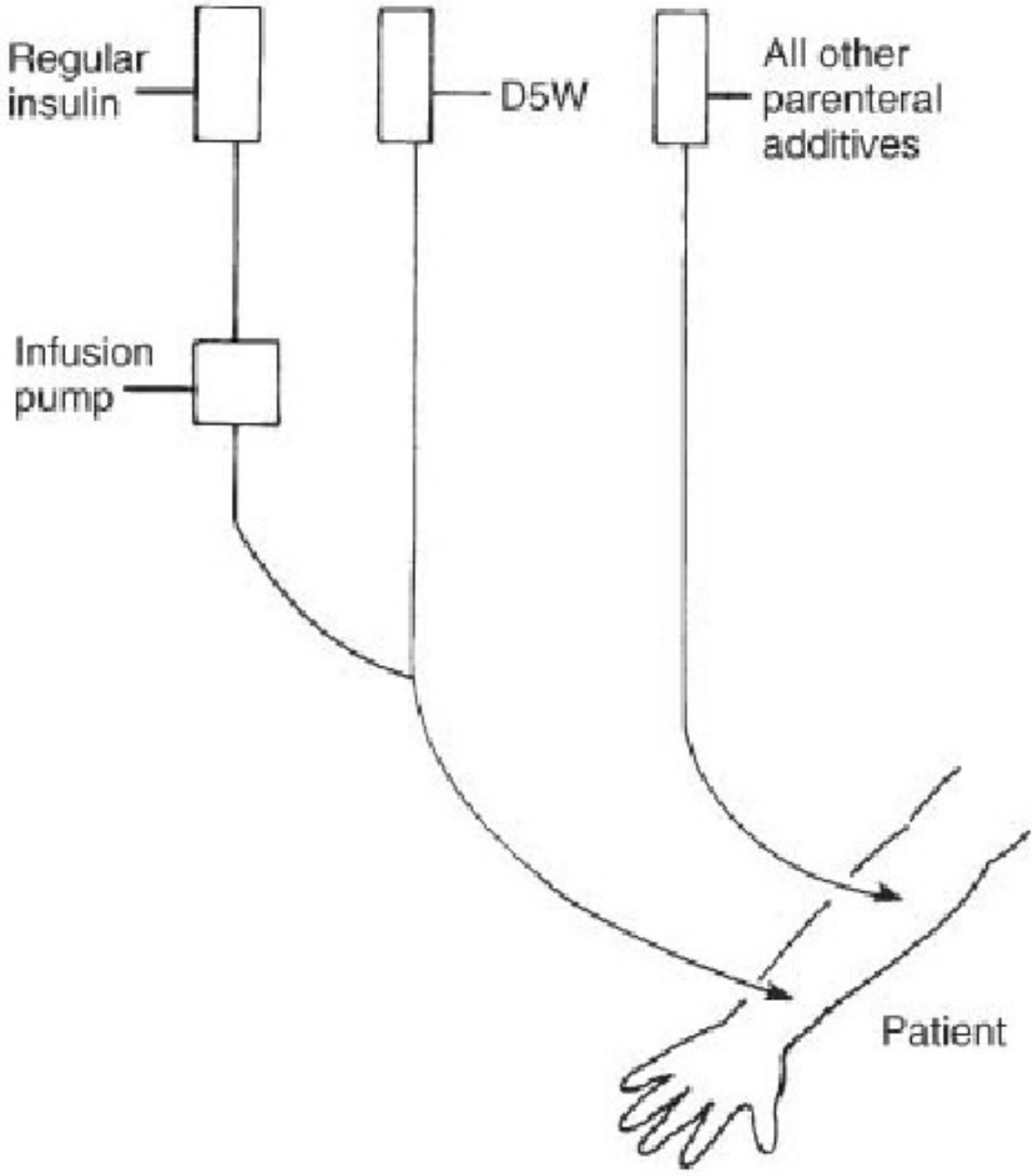
Tight Control" Regimen 1 :-

Aim:

- To keep plasma glucose levels at 79 to 120 mg/dL.

protocol:

- 1. On the evening before surgery, determine the preprandial blood glucose level.
- 2. begin an IVinfusion of 5% dextrose at a rate of 50 mL/hr/70 kg body weight.
- 3. "Piggyback" an infusion of regular Insulin (50 U in 250 mL of 0.9% sodium chloride) to the dextrose infusion with an infusion pump). Before attaching this piggyback line to the dextrose infusion, flush the line with 60 mL of infusion mixture and discard the flushing solution. This approach saturates Insulin binding sites on the tubing.
- 4. infusion rate: Insulin (U/hr) = plasma glucose(mg/dL)/150. (*Note:* The denominator should be 100 if the patient is taking corticosteroids.


Regular insulin
D5W
All other parenteral additives
Infusion pump
Patient

5. 4th hourly measure blood glucose and adjust Insulin appropriately to obtain blood glucose levels of 100 to 200 mg/dL.

6. On the day of surgery, intraoperative fluids and electrolytes are managed by continued administration of non-dextrose-containing solutions, as described in steps 3 and 4.

7. Determine the plasma glucose level at the start of surgery and every 1 to 2 hours for the rest of the 24-hour period. Adjust the Insulin dosage appropriately.

Tight Control" Regimen 2 :-

Aim:-

same as for TCR-1

Protocol:-

- obtain feedback mechanical pancreas & set controls for the desired plasma glucose regimen
- institute 2 IV lines

POST-OP

- Measure blood glucose hourly for 4 hours postoperatively or until stable, whichever is longer, and then 2 hourly.
- For type I patients stop the infusion once they are eating and drinking.
- Calculate the total dose of Insulin in the last 24 hours and divide it into three daily doses and administer this as subcutaneous soluble Insulin.
- Adjust the dose until the patient is stable, aiming to return to their normal regimen.
- For type 2 patients, stop the infusion and restart oral hypoglycaemics once they are eating and drinking.

EMERGENCY SURGERY

- Patient will be in DKA/HHS
  - Large volume of NS and Insulin is given
  - Insulin
    - Bolus – 0.1u/kg
    - Infusion-0.1u/kg/hr
  - Check – BG hrly and electrolytes 2nd hrly
  - If BG <250 – add dextrose
  - Continue infusion till acidosis decreases

Important points to be noted while giving Insulin

1. Absorption of Insulin is highly variable (type, species, site and blood flow)
2. 1 U of Insulin = 25-30 mg%
3. Daycare patients should have preceeding evening Insulin reduced by 10-20% to prevent hypoglycemia early morning

4. Insulin sliding scales have no benefit in poorly controlled surgical patients
5. Intravenous Insulin is the most precise means of managing hyperglycemia perioperatively and several regimes are recommended
6. Interruption of Insulin infusion suddenly leads to sudden metabolic decompensation
7. Insulin is adsorbed to glassware as well as plastic ware. (around 30%)

- Measures to decrease loss

a) Running about 50 ml of infusate rapidly through the tubing to saturate the sites

b) Add small amount of protein to the infusate

8. Higher Insulin dose required in case of administration of RL during surgery

Misc.....

- BZD's – if given by continous infusion, decreases blood glucose (by decreasing the ACTH, decreases cortisol)
- High dose opiate – abolish hyperglycemia by blocking sympathetic response
- Halothane, Enflurane and Isoflurane in vitro, inhibit the Insulin response to glucose in a reversible and dose dependent manner.

- **General medical/surgical**

  Fasting : 90-126 mg%

  Random: < 200 mg%
- **Cardiac surgery**

  < 150 mg%
- **Critically ill**

  < 150 mg%
- **Acute neurologic disorders**

  80 – 140 mg%

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- **GLP-1 agonists**, such as exenatide, can slow gastric motility and potentially delay gastrointestinal recovery after major surgery; they should be held the day of surgery.
- **DPP-4 inhibitors (incretin enhancers)**, such as sitagliptin, do not have significant side effects and, if need be, can be continued. Because incretin therapies act via a glucose-dependent mechanism, they are unlikely to cause hypoglycemia, even in a patient whose oral intake is held or delayed. On the other hand, since their effect is mostly in reducing postprandial glycemia, there may be little need to use them in a patient who is NPO.
- Patients with type 1 diabetes must continue basal insulin replacement preoperatively (0.2 to 0.3 U/kg/day of a long-acting insulin).

Preoperatively,

- In patients with type 2 diabetes, oral agents pose certain safety risks and should be discontinued prior to surgery.
- **Sulfonylureas** may induce hypoglycemia in patients who are placed on NPO ("nothing by mouth") orders and should be held in patients who are fasting.
- **Metformin** can induce lactic acidosis if kidney function declines and should be withheld 1 to 2 days before planned surgery if a need for IV contrast is anticipated or the procedure could potentially lead to hemodynamic instability and reduced renal perfusion.
- **Thiazolidinediones** may cause fluid retention that can complicate the postoperative period; they can be discontinued several days prior to a planned surgery.

Cochrane Library
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Perioperative glycaemic control for diabetic patients undergoing surgery (Review)

Buchleitner AM, Martínez-Alonso M, Hernández M, Solà I, Mauricio D

Buchleitner AM, Martínez-Alonso M, Hernández M, Solà I, Mauricio D.
Perioperative glycaemic control for diabetic patients undergoing surgery.
Cochrane Database of Systematic Reviews 2012, Issue 9. Art. No.: CD007315.
DOI: 10.1002/14651858.CD007315.pub2.

Authors' conclusions

The included trials did not demonstrate significant differences for most of the outcomes when targeting intensive perioperative glycaemic control compared with conventional glycaemic control in patients with diabetes mellitus. However, posthoc analysis indicated that intensive glycaemic control was associated with an increased number of patients experiencing hypoglycaemic episodes. Intensive glycaemic control protocols with near-normal blood glucose targets for patients with diabetes mellitus undergoing surgical procedures are currently not supported by an adequate scientific basis. We suggest that insulin treatment regimens, patient- and health-system relevant outcomes, and time points for outcome measures should be defined in a thorough and uniform way in future studies.

Pediatric Diabetes

ISPAD International Society for Pediatric and Adolescent Diabetes

Pediatric Diabetes 2014: 15 (Suppl. 20): 224–231
doi: 10.1111/pedi.12172

Pediatric Diabetes

ISPAD Clinical Practice Consensus Guidelines 2014 Compendium

Management of children and adolescents with diabetes requiring surgery

Rhodes ET, Gong C, Edge JA, Wolfsdorf JI, Hanas R. Management of children and adolescents with diabetes requiring surgery.
Pediatric Diabetes 2014: 15 (Suppl. 20): 224–231.

Erinn T Rhodes[a,b], Chunxiu Gong[c], Julie A Edge[d], Joseph I Wolfsdorf[a,b] and Ragnar Hanas[e,f]

[a]Division of Endocrinology, Boston Children's Hospital, Boston, MA, USA; [b]Department of Pediatrics, Harvard Medical School, Boston, MA, USA; [c]Endocrinology, Genetics and Metabolism, The Capital Medical University, Beijing Children's Hospital, Beijing, China; [d]Department of Paediatric Endocrinology and Diabetes, Oxford Children's Hospital, Oxford, UK; [e]The Sahlgrenska Academy, University of Gothenburg, Institute of Clinical Sciences, Gothenburg, Sweden and [f]Department of Pediatrics, NU Hospital Group, Uddevalla Hospital, Uddevalla, Sweden

Key words: anesthesia – children – diabetes – guidelines – surgery

Corresponding author: Erinn T Rhodes, MD, MPH,
Division of Endocrinology,
Boston Children's Hospital,
333 Longwood Avenue 6th Floor,
Boston, MA 02115,
USA.
Tel: (1) 617-355-3209;
fax: (1) 617-730-0194;
e-mail: Erinn.Rhodes@childrens.harvard.edu
Editors of the ISPAD Clinical Practice Consensus Guidelines 2014 Compendium: Carlo Acerini, Carine de Beaufort, Maria Craig, David Maahs, Ragnar Hanas.

This article is a chapter in the *ISPAD Clinical Practice Consensus Guidelines 2014 Compendium*. The complete set of guidelines can be found for free download at www.ispad.org. The evidence grading system used in the ISPAD Guidelines is the same as that used by the American Diabetes Association. See page 3 (the Introduction in *Pediatric Diabetes* 2014; 15 (Suppl. 20): 1-3).

Classification of procedures and presurgical assessment

In the management of children with diabetes undergoing surgery it is helpful to divide procedures into two categories:

Minor surgery

Minor surgery requires brief general anesthesia (GA) (or heavy sedation), usually of less than 2 h duration, and should not have a major impact on glycemic control. Examples include common day surgery procedures: endoscopies, duodenal biopsy, adenotonsillectomy, grommet insertion, and simple orthopedic procedures.

The child will usually be discharged from the hospital on the day of the procedure. Likewise, repeated minor procedures performed on hospitalized patients receiving treatment for cancer or patients with severe burns are of short duration (e.g., dressing changes) and may also be considered minor.

Major surgery

Major surgery requires more prolonged GA, is associated with greater risks of metabolic decompensation, and the child is unlikely to be discharged from the hospital on the day of the procedure. These surgeries are typically expected to last for at least 2 h.

Whenever possible, surgery should be performed when diabetes is under optimal control. If circumstances permit a presurgical assessment, this should, ideally, be done several days before the surgery to allow for an assessment of glycemic control, electrolyte status, and ketones (urine or blood). If glycemic control is known to be poor and surgery is not urgent, the procedure should be delayed until glycemic control has improved. If glycemic control is uncertain or poor and surgery cannot be delayed, consider admission to the hospital prior to surgery for assessment and stabilization of glycemic control.

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[a]Division of Endocrinology, Boston Children's Hospital, Boston, MA, USA; [b]Department of Pediatrics, Harvard Medical School, Boston, MA, USA; [c]Endocrinology, Genetics and Metabolism, The Capital Medical University, Beijing Children's Hospital, Beijing, China; [d]Department of Paediatric Endocrinology and Diabetes, Oxford Children's Hospital, Oxford, UK; [e]The Sahlgrenska Academy, University of Gothenburg, Institute of Clinical Sciences, Gothenburg, Sweden and [f]Department of Pediatrics, NU Hospital Group, Uddevalla Hospital, Uddevalla, Sweden

Key words: anesthesia – children – diabetes – guidelines – surgery

Corresponding author: Erinn T Rhodes, MD, MPH,
Division of Endocrinology,
Boston Children's Hospital,
333 Longwood Avenue 6th Floor,
Boston, MA 02115,
USA.
Tel: (1) 617-355-3209;
fax: (1) 617-730-0194;
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Preoperative care for children with type 1 or type 2 diabetes treated with insulin

Children and adolescents with type 1 or type 2 diabetes treated with insulin:

- Must be admitted to the hospital if receiving GA.
  - In cases with documented good control, it should be possible to admit early on the day of surgery for both minor and major procedures. Otherwise, it is preferred to admit in the afternoon before surgery to give time for correction of metabolic status overnight.
- Should be scheduled as the first case of the day.
- Need insulin, even if fasting, to avoid ketoacidosis.
- May initially receive an IV infusion without dextrose for minor surgery or procedures (lasting for less than 2 h) if treated with basal/bolus insulin regimen or continuous subcutaneous insulin infusion (CSII).
- Should initially receive an IV infusion with dextrose for major surgery or procedures (lasting for at least 2 h) or if treated with NPH insulin.
- Require hourly capillary blood glucose monitoring to detect hypoglycemia and hyperglycemia before the procedure. If the blood glucose exceeds 14 mmol/L (~250 mg/dL), a conservative dose of rapid-acting insulin or short-acting insulin (regular) should be administered to restore blood glucose to the target range.
- Should coordinate the timing of preoperative food and fluid restrictions with the anesthetist.
  - The usual recommendation is no solid food for at least 6 h before surgery (20). Clear fluids (and breast milk) may be allowed up to 4 h before surgery (check with anesthetist).
- Require specific adjustment of the insulin schedule depending on the type of surgery (major or minor), the patient's insulin regimen, and the time of the surgical procedure (morning or afternoon). Guidelines for each scenario are presented.

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Major surgery (as defined above)

- On the evening before surgery:
  - Give the usual evening and/or bedtime insulin(s) and bedtime snack.
  - Monitor blood glucose and measure blood ß-hydroxybutyrate (BOHB) or urinary ketone concentration if blood glucose is >14–20 mmol/L (>250–360 mg/dL).
- Omit the usual morning insulin dose.
- At least 2 h before surgery, start an IV insulin infusion [e.g., dilute 50 units regular (soluble) insulin in 50 mL normal saline, 1 unit = 1 mL] and provide IV maintenance fluids consisting of 5% dextrose and half-normal saline (0.45% NaCl) (see Table 1).
- Monitor blood glucose levels at least hourly before surgery and as long as the patient is receiving IV insulin.
- Aim to maintain blood glucose between 5 and 10 mmol/L (90–180 mg/dL) by adjusting the IV insulin dose or the rate of dextrose infusion during surgery.
- When oral intake is not possible, the IV dextrose infusion should continue for as long as necessary.

Minor surgery (as defined above)

Algorithms for different types of insulin regimens are suggested below. For more detail, see reference (5).

(i) Patients treated with twice daily basal (NPH, insulin detemir, or insulin glargine) and rapid- or short-acting insulins:

- Morning operations
  - On the morning of the procedure, give 50% of the usual morning dose of intermediate-acting insulin (NPH) or the full usual morning dose of long-acting insulin (detemir or glargine). With premixed insulin, give only 50% of the equivalent dose of the basal (NPH) component.
  - Omit the short- or rapid-acting insulin unless it is needed to correct hyperglycemia.
  - Commence IV fluids containing dextrose 5–10%, as necessary, to prevent hypoglycemia.
  - Alternatively, IV insulin infusion may be started as described above.
- Afternoon operations (if unavoidable)
  - On the morning of the procedure, give 50% of the usual dose of intermediate-acting insulin (NPH) or the full usual morning dose of long-acting insulin (detemir or glargine). With premixed insulin, give only 50% of the equivalent dose of the basal component (NPH).
  - The dose of short- or rapid-acting insulin will depend on whether the child is permitted to eat breakfast.
  - Alternatively, give 30–40% of the usual morning insulin dose of short- or rapid-acting insulin (but no intermediate- or long-acting insulin) and use an IV insulin infusion beginning at least 2 h before surgery

- If the anesthetist allows the child to eat a light breakfast and to consume clear liquids up to 4 h before the procedure, IV fluid administration (and IV insulin infusion, if applicable) should commence 2 h before surgery or no later than midday (Table 1).

(ii) Patients treated with once daily basal/bolus insulin regimens:

Children on basal/bolus regimens benefit from not discontinuing their basal insulin before minor surgical procedures. This is particularly relevant for children requiring repeated procedures.

- Morning operations
  - On the morning of the procedure, give the usual dose of long-acting insulin (glargine or detemir) if usually given at this time. If preoperative evaluation shows a pattern of low blood glucose values in the morning, consider reducing the dose of long-acting insulin by 20–30%.
  - Omit the short- or rapid-acting insulin unless needed to correct hyperglycemia.
  - Commence IV fluids. Patients with a normal blood glucose may initially utilize IV fluids without dextrose. With an appropriately titrated basal rate and careful monitoring, this approach may be more physiologic (21, 22).
  - Alternatively, IV insulin infusion may be started as described above.
- Afternoon operations (if unavoidable)
  - On the morning of the procedure, give the usual dose of long-acting insulin (if usually given at this time).
  - If allowed to eat breakfast, give the usual dose of rapid-acting insulin or 50% of the usual short-acting insulin.
  - If the anesthetist allows the child to eat a light breakfast and to consume clear liquids up to 4 h before the procedure, IV fluid administration (and IV insulin infusion, if applicable) should commence 2 h before surgery or no later than midday (Table 1).

(iii) Patients treated with CSII:

- If possible, and provided the anesthetist agrees, use of CSII may be continued during a surgical procedure. If the anesthetist is not confident with CSII (pump) management, it is safest to remove the

insulin pump and substitute an IV insulin infusion to deliver insulin, as described above.

- When a child on CSII goes to the operating theatre, it is important to secure the subcutaneous infusion cannula to prevent dislodgement and interruption of insulin delivery during the procedure.
- If the GA is short (<2 h), the pump can continue to infuse insulin at the basal rate appropriate for the time of day.

    - Basal rate can be suspended, if necessary, for no more than 30 min to correct any episodes of mild hypoglycemia.

- Do not give a bolus dose of rapid-acting insulin unless necessary to correct hyperglycemia.
- Commence IV fluids. Patients with a normal blood glucose may initially utilize IV fluids without dextrose. With an appropriately titrated basal rate, this approach may be more physiologic (21, 22).
- Alternatively, IV insulin infusion may be started as described above.

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Perioperative management of diabetic patients: new controversies

P. Aldam[1], N. Levy[2*] and G. M. Hall[3]

[1] Division of Anaesthesia, Addenbrookes Hospital, Cambridge CB2 0QQ, UK
[2] Department of Anaesthesia, West Suffolk Hospital, Bury St Edmunds IP33 2QZ, UK
[3] Department of Anaesthesia, St George's Hospital Medical School, London SW17 0RE, UK

* Corresponding author. E-mail: nicholas.levy@wsh.nhs.uk

We suggest that preoperative $HbA1_c$ values should be determined in all patients undergoing major surgery, and also in all elective surgical patients with diabetes. Not only will this strategy diagnose DM in some patients with undiagnosed DM, it may also influence the timing of elective surgery. Glycated haemoglobin values >8.6% or 70 mmol mol^{-1} were associated with a four-fold increase in mortality after cardiac surgery.[15] Delaying elective major surgery while glycaemic control is improved is predicted to decrease mortality and serious morbidity—an objective that patient and clinician will surely support!

PROTOCOLLO SEMPLIFICATO DI TRATTAMENTO INSULINICO INTENSIVO PER IL PAZIENTE CRITICO DI AREA CHIRURGICA

In area chirurgica si presentano due situazioni tipiche:

- il ricovero del paziente che richiede un intervento chirurgico in **urgenza**
- ed il paziente che deve affrontare un intervento in **elezione**

- Per l'intervento in **elezione** nel paziente diabetico già noto, si prevede di solito un percorso assistenziale specifico, con una rivalutazione del compenso metabolico pre-operatoria, ma la gestione peri-operatoria è la medesima del paziente operato in urgenza.

- Per l'**urgenza** è indispensabile avere condiviso un algoritmo di trattamento dell'iperglicemia grave per affrontare nelle migliori condizioni l'intervento chirurgico in un paziente con iperglicemia, quando non è possibile attendere il consulente diabetologo.

Perioperative management of glucose levels revolves around several key objectives that are briefly elaborated on below:

(i) Reduction of overall patient morbidity and mortality [46, 57].

(ii) Avoidance of severe hyperglycemia or hypoglycemia [46, 57].

(iii) Maintenance of physiological electrolyte and fluid balance [46, 57].

(iv) Prevention of ketoacidosis [46, 57].

[46] H. U. Rehman and K. Mohammed, "Perioperative management of diabetic patients," *Current Surgery*, vol. 60, no. 6, pp. 607–611, 2003.

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Biopsychosocial effects of hypoglycemia during perioperative, postoperative, and rehabilitation period

Biological	Cardiovascular system	Arrhythmogenic
		Proischemic
		Prothrombotic
	Nervous system	Cognitive impairment
		Acute
		Chronic
		Epileptogenic
		Cerbrovascular accident (CVA). mimic
	Retina	Pro-apoptotic
	General	Pro inflammatory
		Endothelial toxin
Psychological		Poor quality of life
		Fear of hypoglycemia
		Difficulty in prayer/mediation
		Impaired sleep quality
Social		Impact on employment
		Productivity
		Impact on driving
		Accidents
		Impact on travel
		Impact on recreation/sports

Causes and risk factors of hypoglycemia anticipated during preanesthetic evaluation

General	Elderly
	Hospitalized patients
	Female gender
	Duration of Diabetes
Lifestyle	Inappropiate meal
	Quantity
	Quality
	Timing
	Inappropriate physical activity
	Intensity
	Duration
	Timing
Drug	Inappropriate choice of
	Drug class
	Dosage
	Timing of administration
	Combination of drugs
Comorbidity	Medical
	Renal impairment
	Hepatic impairment
	gastrointestinal impairment (gastroparesis)
	Endocrine
	Hypopituitarism
	Hypothyroidism
	Hypoadrenalism
	Neurological
	Sleep
	Cognitive impairment
	Autonimic neuropathy
Concomitant medication	Alcohol
	Complementary medicine
	Sedatives
	Other molecules with drug-drug interactions
Hypoglycemia	Prior h/o hypoglycemia
	Impaired awareness of hypoglycemia (IAH)
Management strategy	Polypharmacy
	Tight HbA1c control

Kalra, Sanjay et al. "Hypoglycaemia in Anesthesiology Practice: Diagnostic, Preventive, and Management Strategies." Saudi Journal of Anaesthesia 7.4 (2013): 447–452..

Role of anesthesiologist and intensivist in educating and training for the prevention of hypoglycemia in diabetic patients during preoperative and postoperative period

Nonpharmacological	
Self-discipline	Regular meals
	Regular physical activity
	Regular medication intake
Self-awareness of	Causes of hypoglycemia
	Symptoms of hypoglycemia
	Risks of hypoglycemia
Self-monitoring	Blood glucose awareness training
	Self monitoring of blood glucose
	Record keeping
Self-management	Oral carbohydrate intake: Simple and complex carbohydrates
Shared decision making	Two-way communication with health provider
	Shared decision making related to treatment strategies and treatment goals
Support system	Diabetes education of family members, friends, colleagues
	Availability of easy to use carbohydrates, SC glucagon
Pharmacological	
Choice of drug	Prefer insulin analogues to traditional insulin
	Prefer incretin based therapy to sulfonylureas
	Prefer insulin sensitizes to secretagogues
	Prefer alpha glucosidase inhibitors
Choice of dose	Use of low dose regimes
	Use step up dosage schedules to fixed dosage schedules
	Use small frequent doses instead of single large dose
	Allow patient empowerment of discretion in dose adjustment
Choice of timing	Minimize drug meal times gaps
	Appropriate match between drug dosage and physical activity
	Allow patient empowerment/discretion in adjustment of timing
Choice of drug combinations	Avoid secretagogue and insulin combination

Ten C's to reduce hypoglycemia with insulin use

Choice of insulin type	Prefer Insulin analogues to traditional insulin
Choice of insulin regime	Prefer lesser doses per day to basal bolus regime
Choice of dose	Use low doses
	Practice step up dosage schedules instead of fixed dose schedule
	Follow slow titration algorithms
Choice of timing	Reduce injection-meal time gap
	Inject analogues after meals
Choice of technique	Follow appropriate technique
Carbohydrate counting	Allow patient discretion in calculating dose based upon carbohydrate intake
Concomitant medication	Avoid insulin- sulfonylurea combination
	Avoid insulin with multiple oral drugs
Correlation with physical activity	Teach to avoid strenuous activity which coincides with peak action of insulin, for example, 3 h after regular insulin, 90 min after rapid- acting insulin analogues
Correlation with meals	Ensure 3+3 meal pattern
	Ensure night time snack, especially with NPH insulin
Choice of device	Use devices which provide accurate doses

Kalra, Sanjay et al. "Hypoglycaemia in Anesthesiology Practice: Diagnostic, Preventive, and Management Strategies." Saudi Journal of Anaesthesia 7.4 (2013): 447–452.

DIABETICMedicine

DOI: 10.1111/j.1464-5491.2012.03582

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[11] for the Joint British Diabetes Societies

[1]Norfolk and Norwich University Hospitals, Norwich, [2]West Suffolk Hospital, Bury St Edmonds, [3]Northampton General Hospital, Northampton, [4]Queen Elizabet Hospital, Kings Lynn, [5]National Patient Safety Agency, London, [6]Plymouth Hospital, Plymouth, [7]Bolton Primary Care Trust, Bolton, [8]Charing Cross Hospital, London, [9]Queens Medical Centre, Nottingham, [10]John Radcliffe Hospital, Oxford and [11]Ipswich Hospital and NHS Diabetes, National Clinical Lead for Inpatie Diabetes, Ipswich, UK

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Box 1 Factors favouring perioperative diabetes control by modification of usual glucose-lowering medications

- Good diabetes control prior to admission (HbA_{1c} < 69 mmol/mol, 8.5%)
- High probability that the patient will be capable of self managing their diabetes during the immediate post-operative period
- Short starvation period (only one missed meal)
- Surgery/procedure can be carried out early on a morning or afternoon list

Insulins	Day prior to admission	Day of surgery	
		Patient for morning surgery	Patient for afternoon surgery
Once daily (evening) (e.g. Lantus® or Levemir®. Insulatard® Humulin I®) Insuman®)	No dose change*	Check blood glucose on admission	Check blood glucose on admission
Once daily (morning) (Lantus® or Levemir® Insulatard® Humulin I®) Insuman®)	No dose change	No dose change*. Check blood glucose on admission	No dose change*. Check blood glucose on admission
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
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 the total dose as intermediate acting only in the morning. Do not give any short-acting insulin 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 the total dose as intermediate acting only in the morning. Do not give any short-acting insulin in the morning. Check blood glucose on admission. Leave the evening meal dose unchanged
Three, 4 or 5 injections daily	No dose change	Basal bolus regimen: omit the morning and lunchtime short-acting insulins. Keep the basal unchanged*. Premixed morning 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

*Some units would advocate reduction of usual dose of long-acting analogue by one third. This reduction should be considered for any patient who 'grazes' during the day (see Controversial areas).
Warn the patient that their blood glucose control may be erratic for a few days after the procedure.

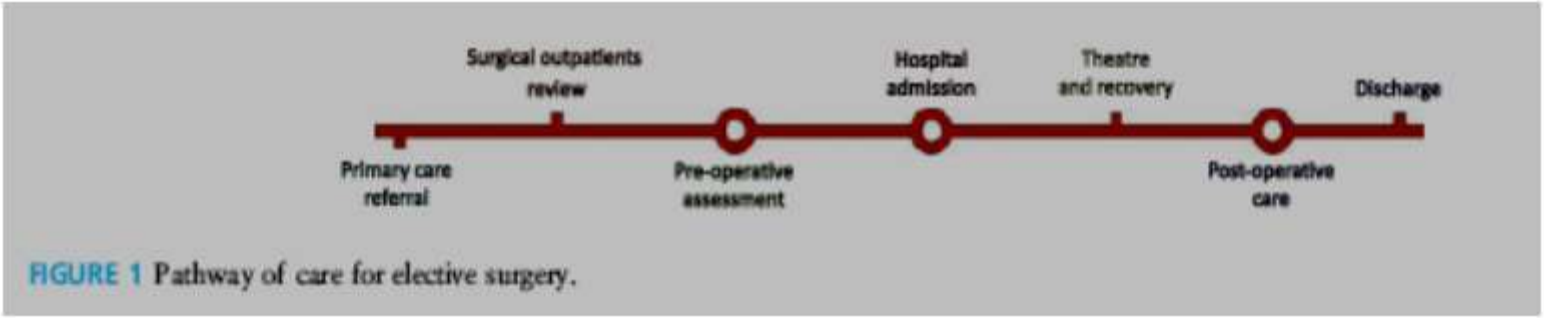

FIGURE 1 Pathway of care for elective surgery.

Diabet. Med. 29, 420–433 (2012)

Appendix 2

Guideline for perioperative adjustment of non-insulin medication (short starvation period—no more than one missed meal)

Tablets	Day prior to admission	Day of surgery	
		Patient for morning surgery	Patient for afternoon surgery
Acarbose	Take as normal	Omit morning dose if 'nil by mouth'	Give morning dose if eating
Meglitinide (repaglinide or nateglinide)	Take as normal	Omit morning dose if 'nil by mouth'	Give morning dose if eating
Metformin (procedure not requiring use of contrast media*)	Take as normal	Take as normal	Take as normal
Sulphonylurea (e.g. Glibenclamide, Gliclazide, Glipizide, Glimeperide.)	Take as normal	Once daily morning omit Twice daily omit morning	Once daily morning omit Twice daily omit morning and afternoon
Pioglitazone	Take as normal	Take as normal	Take as normal
DPP-IV inhibitor (e.g. Sitagliptin, Vildagliptin, Saxagliptin)	Take as normal	Omit on day of surgery	Omit on day of surgery
GLP-1 analogue (e.g. Exenatide, Liraglutide)	Take as normal	Omit on day of surgery	Omit on day of surgery

*If contrast medium is to be used and eGFR less than 50 ml min^{-1} 1.73 m^{-2}, metformin should be omitted on the day of the procedure and for the following 48 h.
DPP-IV, dipeptidyl peptidase 4; GLP-1, glucagon-like peptide 1.

Diabet. Med. 29, 420–433 (2012)

Appendix 3*

Advantages and disadvantages of intravenous solutions

	Advantages	Disadvantages
0.45% saline with 5% glucose with 0.15% potassium chloride at 83–125 ml/h with a continuous variable rate intravenous insulin infusion	• Constant supply of substrate • Meets daily sodium and potassium requirements • Safety profile of regimen demonstrated in the paediatric population with diabetes	• Not widely available • Hypotonic solution *in vivo* with reference to plasma and may still predispose to hyponatraemia • May exceed daily requirements of sodium
0.9% saline with 5% glucose with 0.15% potassium chloride at 83–125 ml/h with a continuous variable rate intravenous insulin infusion	• Constant supply of substrate • Meets sodium and potassium requirements • Safety profile of regimen demonstrated in the paediatric population with diabetes	• Not widely available • Will exceed daily sodium chloride requirement and predispose to oedema and hyperchloraemic metabolic acidosis
0.18% saline with 4% glucose with 0.15% potassium chloride at 83–125 ml/h with a continuous variable rate intravenous insulin infusion	• Constant supply of substrate • Meets daily sodium and potassium requirements • Widely available	• Associated with hyponatraemia. Use in children has been curtailed by the National Patient Safety Agency • Hypotonic solution *in vivo* with reference to plasma
5–10% glucose with 0.15% potassium chloride at 125 ml/h with a continuous variable rate intravenous insulin infusion	• Constant supply of substrate • Widely available	• Does not provide any sodium • Associated with hyponatraemia

Diabet. Med. 29, 420–433 (2012)

Appendix 3* (Continued)

Diabet. Med. 29, 420–433 (2012)

	Advantages	Disadvantages
5–10% glucose with 0.15% potassium chloride at 125 ml/h with additional 0.9% saline at a variable rate to correct the hyponatraemia and a continuous variable rate intravenous insulin infusion	• Constant supply of substrate • Widely available	• Requires three infusion pumps (one for the glucose, one for the saline and one for the insulin) • May need multiple venous access leading to difficulties in obtaining blood samples and venous access • May lead to fluid overload
10% glucose with 0.15% potassium chloride at 60 ml/h with additional 0.9% saline at 60 ml/h with a continuous variable rate intravenous insulin infusion	• Constant supply of substrate • Widely available	• Needs three infusion pumps (one for the glucose, one for the saline and one for the insulin) • May need multiple venous access leading to difficulties obtaining blood samples and venous access • Erratic supply of substrate • Unpredictable administration of sodium • Increased nursing workload and difficulties in maintaining accurate fluid balance charts with constant changes of fluid bags according to capillary blood glucose
10% glucose with 0.15% potassium chloride at 100 ml/h if capillary blood glucose less than 15 mmol/l with a continuous variable rate intravenous insulin infusion 0.9% saline with 0.15% potassium chloride at 100 ml/h if capillary blood glucose more than 15 mmol/l with a continuous variable rate intravenous insulin infusion		
500 ml 10% glucose and 0.15% potassium chloride with 5 units insulin if capillary blood glucose less than 6 mmol/l 500 ml 10% glucose and 0.15% potassium chloride with10 units insulin if capillary blood glucose 6–10 mmol/l 500 ml 10% glucose and 0.15% potassium chloride with 15 units insulin if capillary blood glucose 10–20 mmol/l 500 ml 10% glucose and 0.15% potassium chloride with 20 units insulin if capillary blood glucose more than 20 mmol/l All administered at 100–125 ml/h and with additional 0.9% saline to treat established hyponatraemia	• Intrinsically safe as substrate and insulin are co-administered • Evidence to support its use	• Increased nursing workload and difficulties in maintaining accurate fluid balance charts with constant changes of fluid bags according to capillary blood glucose • Hyponatraemia is a recognized complication • May lead to fluid overload with the co-administration of additional 0.9% saline

*Appendix 6 in main guideline document (see Supporting Information).

The rate of fluid infusion suggested should be for as long as the patient is fasted. Once they are ready to eat and drink, the intravenous fluid infusion can be stopped.

The cost of 0.45% saline with 5% glucose with 0.15% potassium chloride is significantly higher than either 0.9% physiological saline solution or 5% glucose solution. At the time of writing, there have been circuitous discussions between the bulk purchasers in the National Health Service (NHS) and the fluid manufacturers. The manufacturers suggest that the cost of the fluid will go down as demand goes up. However, the NHS purchasers say they will only buy more when the costs come down.

0.45% saline with 5% glucose with 0.15% potassium chloride is widely available, but because it is currently only recommended for use in the paediatric population [82], it is currently most widely stocked in those areas.

Research: Care Delivery

Perioperative diabetes care: room for improving the person centredness

I. Hommel[1], P. J. van Gurp[2], C. J. Tack[2], J. Liefers[1], J. Mulder[1], H. Wollersheim[1] and M. E. J. L. Hulscher[1]

[1]Department of IQ Healthcare, Radboud University Medical Center, Nijmegen and [2]Department of Internal Medicine, Radboud University Medical Center, Nijmegen, The Netherlands

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Conclusions Current perioperative diabetes care is characterized by a lack of patient information and limited patient involvement. These results indicate that there is ample room for improving the person centredness of perioperative diabetes care.

Diabet. Med. 32, 561–568 (2015)

Table 3 Determinants of patient-centred perioperative diabetes care*

	Dimensions of patient-centred care							
	Information		Patient involvement		Communication and education		Coordination	
Determinant	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*
Overall mean	2.29 (0.88)		2.52 (0.88)		3.42 (0.79)		2.22 (0.84)	
Age (years)								
≤ 70	2.42 (0.89)	0.002	2.70 (0.81)	0.001	3.37 (0.77)	0.492	2.34 (0.81)	0.012
> 70	2.15 (0.85)		2.31 (0.90)		3.45 (0.81)		2.07 (0.86)	
Treatment								
No insulin	2.14 (0.81)	0.281	2.34 (0.86)	< 0.001	3.41 (0.83)	0.987	2.09 (0.81)	0.005
Insulin	2.51 (0.92)		2.79 (0.83)		3.40 (0.71)		2.40 (0.85)	
Length of stay								
≤ 1 week	2.32 (0.85)	0.753	2.55 (0.93)	0.999	3.38 (0.82)	0.590	2.10 (0.77)	0.003
> 1 week	2.26 (0.91)		2.49 (0.80)		3.44 (0.74)		2.37 (0.84)	
Interaction Age × Treatment†								
≤ 70 years, no insulin	2.35 (0.87)	0.027						
≤ 70 years, insulin	2.49 (0.90)							
> 70 years, no insulin	1.95 (0.71)							
> 70 years, insulin	2.56 (0.95)							

*The mean scores for the dimensions range from 1 (low) to 4 (high).
†Interaction Age × Treatment was significant only for the dimension 'information'.

Take Home Messages

- **Programmare** l'intervento nel paziente diabetico quando glicemia, idratazione e compenso elettrolitico sono ottimizzati
- **Contestualizzare le Linee Guida** sulla cura del paziente diabetico in Ospedale
- **Condividere** le stesse con Primary Care, Chirurgia, Rianimazione, Diabetologia, Servizio Infermieristico, Laboratorio, Direttori di Strutture, Centro Elaborazione dati, Direzione Sanitaria (GLAM)

DUBIUM SAPIENTIAE INITIUM

Cartesio


Da soli sarebbe impossibile…
Ma con un approccio multidisciplinare possiamo farcela !
GRAZIE PER L'ATTENZIONE !

Link tra iperglicemia e outcomes sfavorevoli nel paziente diabetico ospedalizzato

Table 9—*Conditions causing erroneous bedside blood glucose results*

Sources of analytical error	Sources of user error
Low hematocrit*	Inadequate meter calibration
High hematocrit†	Using a test strip that does not match the meter code or that has passed the expiration date
Shock and dehydration‡	Inadequate quality-control testing
Hypoxia‡	Poor meter maintenance
Hyperbilirubinemia, severe lipemia*	Poor technique in performing fingerprick
Specimen additives: sodium flouride†	Poor technique of applying drop of blood to the test strip
Drugs—acetaminophen overdose, ascorbic acid, dopamine, fluorescein, mannitol, salicylate‡	Failure to record results in patient's chart or to take action if blood glucose is out of target range

*Falsely elevates result; †falsely lowers result; ‡can either falsely lower or elevate result, depending on the device used.

Diabetes Care, volume 27, numero 2, Febbraio 2004

Calcolo del fattore di Correzione individuale

1800/TDD= calo della glicemia in mg/dl per ogni unità di insulina ultrarapida

Formula per Bolo di Correzione

$$\frac{\text{Glicemia misurata} - \text{Glicemia desiderata}}{\text{Fattore di correzione}}$$

Esempio:

- ✓Glicemia: 250 mg/dl
  Glic ideale: 100 mg/dl
- ✓Fattore di correzione: 30 mg/dl

$$\frac{250 - 100}{30} = 5.0\text{U}$$

Narcotici

- Benzodiazepine (aumentano il GH)
- Oppioidi (riducono il catabolismo ormonale)
- Nella tecnica di induzione di ipotensione controllata i gangliоplegici possono causare ipoglicemia per blocco del simpatico.
- Il N_2O, i miorilassanti (depolarizzanti e competitivi), gli alogenati volatili: non influenzano in modo apprezzabile la glicemia.
- Quando possibile preferire l'anestesia locale.

§Protocollo di Gestione Chirurgica del paziente con diabete in ospedale (raccomandazioni principali):

- Identificare i pazienti che possono effettuare l'intervento in **day-surgery**
- Identificare i **pazienti ad alto rischio** e organizzare transitoria degenza post-intervento in unità di terapia intensiva o area a elevata intensità di cura
- Identificare i pazienti che necessitano di **infusione insulinica ev** nel peri-operatorio
- Identificare i pazienti che necessitano di **nutrizione parenterale** totale dopo l'intervento
- Evitare, se possibile, **digiuni** prolungati
- Evitare trattamenti insulinici ev se il digiuno è breve (1 pasto)
- Ridurre i tempi del digiuno pre-operatorio dando priorità ai pazienti diabetici nella lista operatoria, oppure se questo non è possibile consentire la somministrazione di liquidi chiari sino a 4h prima dell'intervento

Tabella 5 ♦ Ripresa dell'alimentazione per os (18)

IL PAZIENTE È IN GRADO DI ALIMENTARSI (ALMENO IL 50% DELLA DIETA PRESCRITTA)?	
SI	NO
Riprendere il regime terapeutico precedente (insulina o ipoglicemizzanti orali): controllare la creatininemia prima di riprendere la terapia con metformina.	Mantenere la terapia insulinica e.v. o s.c. secondo le condizioni cliniche. Considerare la terapia infusionale se le glicemia sono superiori a 180 mg/dl.

18. Centre for Healthcare Improvement. Patient Safety and quality improvement service. Inpatient guidelines: Insulin infusion pump management: **The state of Queensland. Available from https://www.health.qld.gov.au/cpic/documents/inpatient_ guidelines.pdf.**

Tabella 4 ♦ Variazioni delle dosi di insulina nel postoperatorio (17)

INTERVENTO CHIRURGICO MAGGIORE	INTERVENTO CHIRURGICO MINORE			
	Glicemia <70 mg/dl	Glicemia 70-100 mg/dl	Glicemia 101-180 mg/dl	Glicemia >180 mg/dl
Terapia insulinica e.v.	Somministrare 100 ml glucosata 10% e.v. oppure 25-50 ml al 33% controllo glicemia ogni 15 min.	Somministrare glucosata 5% alla velocità di 40 ml/ ora controllo glicemico ogni ora	Mantenere la terapia ipoglicemizzante in atto. Monitorare la glicemia ogni 2 ore	Iniziare terapia insulinica e.v. o insulina s.c.

17. Joslin Diabetes Center and Joslin Clinic Guideline for inpatient management of surgical and ICU patients with diabetes.
Pre, Peri and Postoperative Care 10/02/2009.

Common clinical presentations of autonomic dysfunction

Organ System	Symptoms	Comments
CAN	• Resting tachycardia	Dominant sympathetic system
	• Loss of heart rate variability	Earliest manifestation of CAN
	• Postural hypotension	
	• Exercise intolerance	Indicates inability to increase heart rate, blood pressure, and cardiac output
	• Dizziness	
	• Silent ischemia	
	• Abnormal baroreceptor responsiveness	
Genitourinary	• Impotence	
	• Urinary retention	
Gastrointestinal	• Gastroparesis	
	• Diarrhea	
Peripheral	• Abnormal sweating	
	• Inability to perceive hypoglycemia	

Abbreviation: CAN, cardiovascular autonomic neuropathy.

Anesthesiology Clin 34 (2016) 155–169

Perioperative Response to Surgery and Anesthesia

- **Fasting** and **volume depletion** contribute to metabolic decompensation.
- Type I DM: **Diabetic ketoacidosis** may develop in the absence of severe hyperglycemia because of inadequate insulin availability during a time of increased demand
- Type 2 DM: **Hyperglycemic hyperosmolar nonketotic** states
- Infection
- Wound healing
- Local and epidural anesthesia: minimal effect

Day-of-surgery adjustment of single peakless or intermediate-acting insulins (eg, glargine as sole agent, NPH insulin, or premixed insulins)

This formula uses the predicted or actual time of fasting and the usual time interval between doses of insulin:

$$\frac{[\text{Dosing interval (h)} - \text{Hours of fast during interval}]}{\text{Dosing interval (h)}} = \text{fraction of insulin to give}$$

Calculation for correction dose insulin using rule of 1800/1500

1800 ÷ TDD = the mg/dL decrease in BG with each unit of rapid-acting insulin given (or 1500 for patients *less* sensitive to insulin)

TDD of insulin = basal + *nutritional doses*

For example: 30 U glargine (once a day) + *30 U lispro* (6 U at breakfast, 10 U at lunch, and 14 U at dinner) = 60 U

Correction dose: How much will this patient's BG decrease with 1 U of lispro?

1800 ÷ 60 = 30 mg/dL predicted decrease in BG with each unit of insulin

To decrease this patient's BG by 150 mg/dL, administer 5 U of lispro.

1500 ÷ 60 = 25 mg/dL predicted decrease in BG with each unit of insulin (lower, patient is *less* sensitive to insulin)

To decrease this patient's BG by 150 mg/dL, administer 6 U of lispro.

From Vann MA. Perioperative management of ambulatory surgical patients with diabetes mellitus. Curr Opin Anaesthesiol 2009;22(6):718–24; with permission.

Diabete e Chirurgia

Condizione	Fabbisogno insulinico
Diabete non complicato	0,3-0,4 U/Kg
Epatopatie	0,5-0,6 U/Kg
Obesità	0,4-0,6 U/Kg
Sepsi	0,6-0,8 U/Kg
Terapia steroidea	0,6-0,8 U/Kg
CEC	0,8-1,2 U/Kg

Original Article

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doi: 10.11622/smedj.2016029

Perioperative glycaemic control in diabetic patients undergoing cataract surgery under local anaesthesia: a survey of practices of Singapore ophthalmologists and anaesthesiologists

Jyh Haur Woo[1], MBBS, MMed, *Wei Di Ng*[2], *Maaz Mohammad Salah*[2], *Kumari Neelam*[3], FRCS, PhD, *Kah-Guan Au Eong*[3,4,5], FRCSE, FAMS, *Chandra Mohan Kumar*[6], FFARCS, FRCA

INTRODUCTION Perioperative glycaemic control is an important aspect of clinical management in diabetic patients undergoing cataract surgery under local anaesthesia. While poor long-term glycaemic control has significant implications for surgery, perioperative hypoglycaemia or hyperglycaemia may also compromise patient safety and surgical outcomes. We aimed to survey ophthalmologists and anaesthesiologists on their approach and to identify the prevalent practice patterns in Singapore.

METHODS This was a cross-sectional questionnaire-based survey conducted in four public hospitals in Singapore with established ophthalmology and anaesthesia units. Respondents were approached individually, and the self-administered questionnaires comprised questions related to practice patterns, clinical scenarios and awareness of pre-existing guidelines.

RESULTS A total of 129 doctors responded to the questionnaire survey. 76 (58.9%) were from ophthalmology departments and 53 (41.1%) were from anaesthesia departments. The majority chose to withhold oral hypoglycaemic agents (82.9%) and/or insulin (69.8%), and keep the patient fasted preoperatively. A blood glucose level ≥ 17 mmol/L prompted 86.0%–93.8% of respondents to adopt a treat-and-defer strategy, while a level ≥ 23 mmol/L prompted 86.0%–96.9% of respondents to cancel the cataract surgery. The respondents were consistently more concerned about perioperative hyperglycaemia (n = 99, 76.7%) than intraoperative hypoglycaemia (n = 83, 64.3%).

CONCLUSION The current study presented the prevalent practice patterns of ophthalmologists and anaesthesiologists in the perioperative management of diabetic patients undergoing cataract surgery in four public hospitals in Singapore. Further research in this field is required, and may be useful for the future formulation of formal guidelines and protocols.

Keywords: cataract, diabetes mellitus, glycaemic control, local anaesthesia

Table I. Respondents by speciality and grade of appointment (n = 129).

Speciality	No. (%)					
	Senior consultant	Consultant/associate consultant	Registrar	Medical officer	Others	Total
Anaesthesia	9 (11.8)	18 (23.7)	8 (10.5)	38 (50.0)	3 (3.9)	76
Ophthalmology	4 (7.5)	12 (22.6)	14 (26.4)	22 (41.5)	1 (1.9)	53
Total	13 (10.1)	30 (23.3)	22 (17.1)	60 (46.5)	4 (3.1)	129

Table II. Preoperative regimens that respondents preferred for patients on oral hypoglycaemic agents.

Regimen	No. (%)		
	Anaesthesiologist (n = 76)	Ophthalmologist (n = 53)	Total (n = 129)
Withhold dose and keep patient fasted	66 (86.8)	41 (77.4)	107 (82.9)
Withhold dose and order GKI therapy	16 (21.1)	6 (11.3)	22 (17.1)
Maintain dose and usual breakfast	2 (2.6)	7 (13.2)	9 (7.0)

GKI: glucose-potassium-insulin

Table III. Preoperative regimens that respondents preferred for patients on insulin.

Regimen	No. (%)		
	Anaesthesiologist (n = 76)	Ophthalmologist (n = 53)	Total (n = 129)
Withhold dose and keep patient fasted	51 (67.1)	39 (73.6)	90 (69.8)
Withhold dose and order GKI therapy	29 (38.2)	14 (26.4)	43 (33.3)
Reduce dose and keep patient fasted	8 (10.5)	7 (13.2)	15 (11.6)
Reduce dose with usual meal	2 (2.6)	0	2 (1.6)
Maintain dose and usual meal	1 (1.3)	7 (13.2)	8 (6.2)

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Original Article

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Reduce dose and keep patient fasted	8 (10.5)	7 (13.2)	15 (11.6)
Reduce dose with usual meal	2 (2.6)	0	2 (1.6)
Maintain dose and usual meal	1 (1.3)	7 (13.2)	8 (6.2)

GKI: glucose-potassium-insulin

AMD – ANMCO – ANMDO – SIC – SIMEU – FIMEUC

PROFILO DI CURA DEL PAZIENTE DIABETICO RICOVERATO PER UN INTERVENTO CHIRURGICO D'ELEZIONE

REV 04 - 19/02/2014

Matrice delle Responsabilità

Attività		Funzioni				
Cosa fare	Come agire	Diabetologo	Chirurgo	Infermiere Reparto	Infermiere Diabetologia	Anestesista
Preospedalizzazione chirurgica	Esami ematochimici e strumentali funzionali alla patologia chirurgica e alla condizione di diabetico	I	R#	-	-	C
Identificazione del rischio anestesiologico	Anamnesi e valutazione clinica anestesiologica con richiesta di eventuali ulteriori accertamenti	I	I	-	-	R#
Valutazione diabetologica prericovero	Definizione di un piano di cura personalizzato sulla base di: grado di compenso glicemico, tipo di diabete, tipo di terapia in atto, complicanze del diabete, comorbilità, tipo di intervento chirurgico, tempi di attesa, etc.	R	I	-	C	I
Attuazione del protocollo di gestione chirurgica del paziente con diabete (vedi paragrafo relativo)	Percorso chirurgico condiviso con ottimizzazione della sequenzialità delle azioni	C	R	C	I	I
Presa in carico diabetologica durante il ricovero	Identificazione, sorveglianza e risoluzione dei problemi diabetologici da parte del team diabetologico	R*	C	C	C*	C
Definizione del setting di dimissione necessario	Valutazione della tipologia di dimissione in relazione ai bisogni clinici e socio-assistenziali: trasferimento in riabilitazione, in lungodegenza, dimissione protetta in ADI, dimissione ordinaria	C	R	C	I	-
Organizzazione della dimissione	Organizzazione delle modalità di dimissione in relazione al setting definito.	I	C	R	I	-
Garanzia dei bisogni educazionali durante il ricovero e alla dimissione	Survival kit (base) e/o interventi personalizzati (autocontrollo, terapia iniettiva) attuati dal team diabetologico	C*	I	C	R*	-
Dimissione (1)	Lettera di dimissione che comprenda un'informativa diabetologica personalizzata, considerando che il paziente sia in carico o no a servizio diabetologico (al diabetologo curante e/o al MMG)	C	R	C	C	I
Dimissione (2)	Garanzia dei presidi terapeutici necessari e dei piani terapeutici per farmaci antidiabetici e autocontrollo glicemico	C*	I	I	R*	I

R = Responsabile; C = Coinvolto; I = Informato; # coinvolgimento di infermiere di area "prericovero"; * azione svolta dal team diabetologico (medico, infermiere, dietista).

Rischi potenziali per il diabetico trattato con terapia chirurgica

- Iperglicemia e chetosi
  - *stress chirurgico*
- Ipoglicemia
  - *insulina a lunga durata d'azione*
  - *ipoglicemizzanti orali*
- Problemi iatrogeni di compenso del diabete
  - *monitoraggio inadeguato*
  - *mancato utilizzo di protocolli*
  - *trascuratezza nell'intervento*
- Complicanze perioperatorie
  - infezione delle ferite
  - infarto del miocardio

Gill GV, 2003, in Pickup JC & Williams G Textbook of Diabetes, Blackwell