Sladkorna bolezen in kirurški poseg

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Abstract

Objective: To determine the relationship between preoperative glucose levels and perioperative mortality in noncardiac, nonvascular surgery.

Research design and methods: We performed a case–control study in a cohort of 108 593 patients who underwent noncardiac surgery at the Erasmus MC during 1991–2001. Cases were 989 patients who underwent elective noncardiac, nonvascular surgery and died within 30 days during hospital stay. From the remaining patients, 1879 matched controls (age, sex, calendar year, and type of surgery) were selected. Information was obtained regarding the presence of cardiac risk factors, medication, and preoperative laboratory results. Preoperative random glucose levels <5.6 mmol/l (110 mg/dl) were normal. Impaired glucose levels in the range of 5.6–11.1 mmol/l were prediabetes. Glucose levels ≥ 11.1 mmol/l (200 mg/dl) were diabetes.

Results: Preoperative glucose levels were available in 904 cases and 1247 controls. A cardiovascular complication was the primary cause of death in 207 (23%) cases. Prediabetes glucose levels were associated with a 1.7-fold increased mortality risk compared with normoglycemic levels (adjusted odds ratio (OR) 1.7 and 95% confidence interval (CI) 1.4–2.1; $P<0.001$). Diabetes glucose levels were associated with a 2.1-fold increased risk (adjusted OR 2.1 and 95% CI 1.3–3.5; $P<0.001$). In cases with cardiovascular death, prediabetes glucose levels had a threefold increased cardiovascular mortality risk (adjusted OR 3.0 and 95% CI 1.7–5.1) and diabetes glucose levels had a fourfold increased cardiovascular mortality risk (OR 4.0 and 95% CI 1.3–12).

Conclusions: Preoperative hyperglycemia is associated with increased (cardiovascular) mortality in patients undergoing noncardiac, nonvascular surgery.

European Journal of Endocrinology **156** 137–142

Noordzij PG et al, European Journal of Endocrinology (2007) 156 137–142

Annals of Internal Medicine | ARTICLE

Intensive Intraoperative Insulin Therapy versus Conventional Glucose Management during Cardiac Surgery

A Randomized Trial

Gunjan Y. Gandhi, MD, MSc; Gregory A. Nuttall, MD; Martin D. Abel, MD; Charles J. Mullany, MD; Hartzell V. Schaff, MD; Peter C. O'Brien, PhD; Matthew G. Johnson, MPH; Arthur R. Williams, PhD; Susanne M. Cutshall, RN; Lisa M. Mundy, RN; Robert A. Rizza, MD; and M. Molly McMahon, MD

Background: It is not known whether rigorous intraoperative glycemic control reduces death and morbidity in cardiac surgery patients.

Objective: To compare outcomes of intensive insulin therapy during cardiac surgery with those of conventional intraoperative glucose management.

Design: A randomized, open-label, controlled trial with blinded end point assessment.

Setting: Tertiary care center.

Patients: Adults with and without diabetes who were undergoing on-pump cardiac surgery.

Measurements: The primary outcome was a composite of death, sternal infections, prolonged ventilation, cardiac arrhythmias, stroke, and renal failure within 30 days after surgery. Secondary outcome measures were length of stay in the intensive care unit and hospital.

Intervention: Patients were randomly assigned to receive continuous insulin infusion to maintain intraoperative glucose levels between 4.4 (80 mg/dL) and 5.6 mmol/L (100 mg/dL) ($n = 199$) or conventional treatment ($n = 201$). Patients in the conventional treatment group were not given insulin during surgery unless glucose levels were greater than 11.1 mmol/L (>200 mg/dL). Both groups were treated with insulin infusion to maintain normoglycemia after surgery.

Results: Mean glucose concentrations were statistically significantly lower in the intensive treatment group at the end of surgery (6.3 mmol/L [SD, 1.6] [114 mg/dL {SD, 29}] in the intensive treatment group vs. 8.7 mmol/L [SD, 2.3] [157 mg/dL {SD, 42}] in the conventional treatment group; difference, −2.4 mmol/L [95% CI, −2.8 to − 1.9 mmol/L] [−43 mg/dL {CI, −50 to − 35 mg/dL}]). Eighty two of 185 patients (44%) in the intensive treatment group and 86 of 186 patients (46%) in the conventional treatment group had an event (risk ratio, 1.0 [CI, 0.8 to 1.2]). More deaths (4 deaths vs. 0 deaths; $P = 0.061$) and strokes (8 strokes vs. 1 strokes; $P = 0.020$) occurred in the intensive treatment group. Length of stay in the intensive care unit (mean, 2 days [SD, 2] vs. 2 days [SD, 3]; difference, 0 days [CI, −1 to 1 days]) and in the hospital (mean, 8 days [SD, 4] vs. 8 days [SD, 5]; difference, 0 days [CI, −1 to 0 days]) was similar for both groups.

Limitations: This single-center study used a composite end point and could not examine whether outcomes differed by diabetes status.

Conclusions: Intensive insulin therapy during cardiac surgery does not reduce perioperative death or morbidity. The increased incidence of death and stroke in the intensive treatment group raises concern about routine implementation of this intervention.

Ann Intern Med. 2007;146:233-243. www.annals.org
For author affiliations, see end of text.
ClinicalTrials.gov registration number: NCT00282698.

Conclusion

Glucose concentrations can be maintained close to normal during cardiac surgery when insulin is infused intravenously as part of an intensive insulin treatment protocol. Compared with initiation of insulin when glucose concentration remains persistently greater than 11.1 mmol/L (200 mg/dL), intensive intraoperative insulin therapy did not reduce death or morbidity when added to strict postoperative glucose control. Substantial additional resources were required.

We cannot exclude the possibility of harm to patients, given the increased rate of death and stroke in the intensive treatment group.

Gandhi GY et al, Ann Intern Med 2007; 146: 233-243

Komentar Greet Van den Berghe:

Adding tight blood glucose control during surgery does not cause a large additional benefit compared with starting tight blood glucose control in intensive care.

If clinicians require a large benefit to change clinical practice, they should not implement tight glucose control during surgery.

That the 4 deaths in the study all occurred in the intervention group, although this is possibly due to a chance occurrence given the small sample size and the low overall mortality rate, further supports **caution about adopting intraoperative tight glucose control.** However, a reliable test to prove or exclude that intraoperative tight blood glucose control has a small effect on the outcome of cardiac surgical patients would require a much larger study than Gandhi and colleagues performed. Perhaps someone will do such a study.

Until then, we should regard tight glucose control during cardiac surgery as experimental and confine its use to clinical trials.

Van den Berghe G, Ann Intern Med 2007; 146: 307-308

VIA MEDICA

ORIGINAL ARTICLE

Cardiology Journal
2008, Vol. 15, No. 5, pp. 422–430

ISSN 1897–5593

Effect of blood glucose levels on prognosis in acute myocardial infarction in patients with and without diabetes, undergoing percutaneous coronary intervention

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Results

There were 1,310 consecutive patients admitted who met inclusion criteria and underwent PCI. The study group included 352 (26.9%) patients with DM and 958 (73.1%) patients without DM.

Conclusions

Elevated blood glucose levels in acute myocardial infarction affect the prognosis of patients without diabetes mellitus; however, it is not an independent risk factor of fatal outcome in patients with diabetes treated with PCI.

BJA

"I would have everie man write what he knowes and no more."–Montaigne

BRITISH JOURNAL OF ANAESTHESIA

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British Journal of Anaesthesia **103** (3): 331–4 (2009)
doi:10.1093/bja/aep226

Editorial *Webster & Galley*

Does strict glucose control improve outcome?

In conclusion, tight glucose control is probably not beneficial in the critically ill and may even be **harmful**, even less is known about any effect in patients undergoing surgery.

Equally, the importance of the excessive use of insulin in this group of patients is unclear.

Perhaps the time has come for an appraisal of what is the effect in Atkins approach to the management of hyperglycaemia. An investigation of the use of carbohydrate restriction to control circulating glucose concentrations in both the critically ill and the perioperative patients is the next logical step.

■ REVIEW ARTICLES

David S. Warner, M.D., and Mark A. Warner, M.D., Editors

Anesthesiology 2009; 110:408–21

Perioperative Glycemic Control

An Evidence-based Review

Angela K. M. Lipshutz, M.D., M.P.H., Michael A. Gropper, M.D., Ph.D.†*

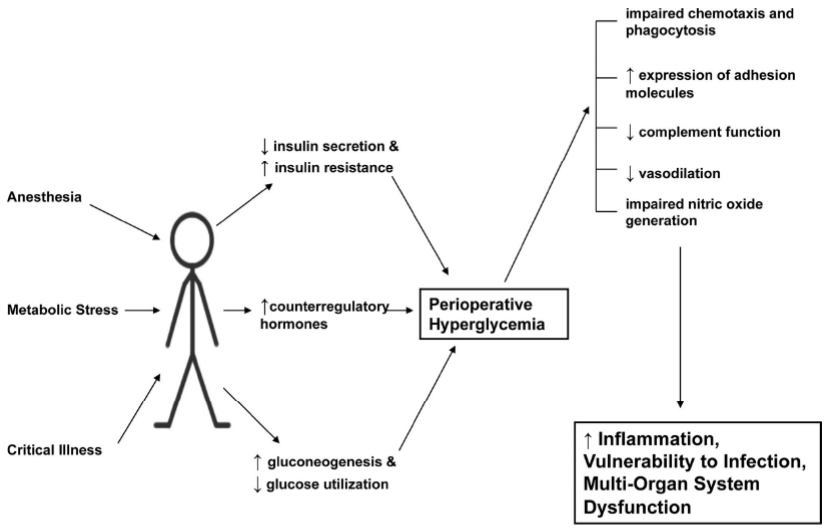


Fig. 1. Pathophysiology of hyperglycemia. Anesthesia, metabolic stress, and critical illness lead to metabolic derangements, resulting in hyperglycemia. Hyperglycemia is associated with increased inflammation, susceptibility to infection, and organ dysfunction.

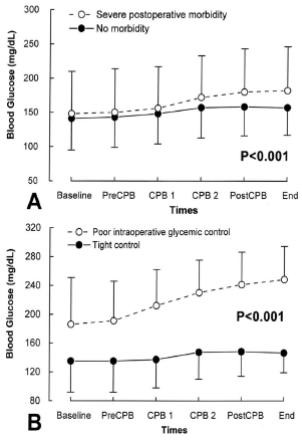
Lipshutz AKM, Gropper MA. Anesthesiology 2009; 110:408–21

■ CLINICAL INVESTIGATIONS

Anesthesiology 2005; 103:687–94

Poor Intraoperative Blood Glucose Control Is Associated with a Worsened Hospital Outcome after Cardiac Surgery in Diabetic Patients

Alexandre Ouattara, M.D., Patrick Lecomte, M.D.,† Yannick Le Manach, M.D.,† Marc Landi, M.D.,* Sophie Jacqueminet, M.D.,‡ Igor Platonov, M.D.,† Nicolas Bonnet, M.D.,§ Bruno Riou, M.D., Ph.D.,‖ Pierre Coriat, M.D.#*



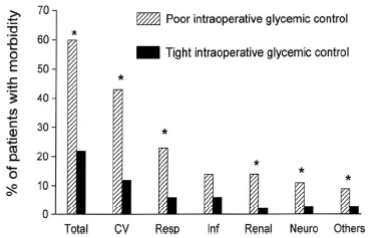


Fig. 2. Incidence of severe in-hospital morbidity between patients in whom intraoperative glycemic control was poor or tight. CV = cardiovascular morbidity; Inf = infectious morbidity; Neuro = neurologic morbidity; Resp = respiratory morbidity (see text for definitions of different morbidities). * $P < 0.05$ *versus* tight control.

Quattara et al. Anesthesiology 2005; 103:687–94

Strict glycemic control reduces EuroSCORE expected mortality in diabetic patients undergoing myocardial revascularization

Cosimo D'Alessandro, MD,[a] Pascal Leprince, MD, PhD,[a] Jean Louis Golmard, PhD,[c] Alexandre Ouattara, MD, PhD,[b] Stéphane Aubert, MD,[a] Alain Pavie, MD,[a] Iradj Gandjbakhch, MD,[a] and Nicolas Bonnet, MD[a]

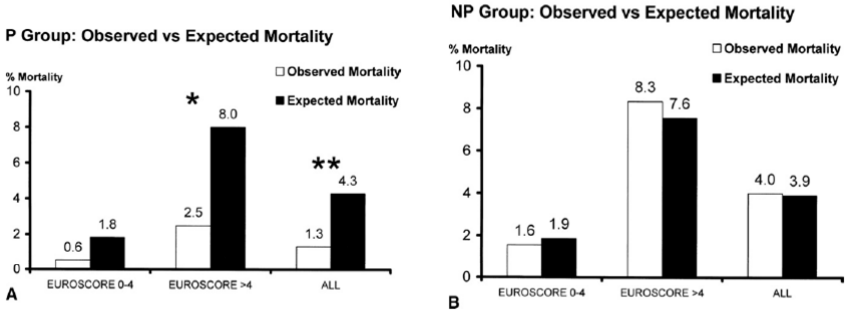


Fig 2. A, Comparison between observed and expected mortality in group P. χ^2 Test: *$P = .03$, **$P = .01$. B, Comparison between observed and expected mortality in group NP.

D'Alessandro C et al. J Thorac Cardiovasc Surg 2007;134:29-37

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

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Tight Glycemic Control in Diabetic Coronary Artery Bypass Graft Patients Improves Perioperative Outcomes and Decreases Recurrent Ischemic Events

Harold L. Lazar, Stuart R. Chipkin, Carmel A. Fitzgerald, Yusheng Bao, Howard Cabral and Carl S. Apstein

Circulation 2004;109;1497-1502; originally published online Mar 8, 2004;
DOI: 10.1161/01.CIR.0000121747.71054.79
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 Print ISSN: 0009-7322. Online ISSN: 1524-4539

Background—This study sought to determine whether tight glycemic control with a modified glucose-insulin-potassium (GIK) solution in diabetic coronary artery bypass graft (CABG) patients would improve perioperative outcomes.

Methods and Results—One hundred forty-one diabetic patients undergoing CABG were prospectively randomized to tight glycemic control (serum glucose, 125 to 200 mg/dL) with GIK or standard therapy (serum glucose <250 mg/dL) using intermittent subcutaneous insulin beginning before anesthesia and continuing for 12 hours after surgery. GIK patients had lower serum glucose levels (138±4 versus 260±6 mg/dL; $P<0.0001$), a lower incidence of atrial fibrillation (16.6% versus 42%; $P=0.0017$), and a shorter postoperative length of stay (6.5±0.1 versus 9.2±0.3 days; $P=0.003$). GIK patients also showed a survival advantage over the initial 2 years after surgery ($P=0.04$) and decreased episodes of recurrent ischemia (5% versus 19%; $P=0.01$) and developed fewer recurrent wound infections (1% versus 10%, $P=0.03$).

Conclusions—Tight glycemic control with GIK in diabetic CABG patients improves perioperative outcomes, enhances survival, and decreases the incidence of ischemic events and wound complications. **(*Circulation*. 2004;109:1497-1502.)**

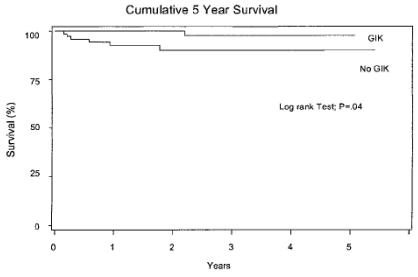

Figure 5. Long-term survival. Survival was prolonged in patients treated with GIK because of decreased mortality in GIK patients over initial 2 years after surgery.

TABLE 4. Postoperative Results

Variable	GIK (n=72)	No GIK (n=69)	*P*
30-Day mortality	0	0	0.99
Myocardial infarction, n (%)	0 (0)	2 (2.8)	0.46
Pacing, n (%)	10 (13.8)	27 (39)	0.001
Atrial fibrillation, n (%)	12 (16.6)	29 (42)	0.002
Infections (pneumonia and wound), n (%)	0 (0)	9 (13)	0.01
Time on ventilators, h	6.9±0.3	10.7±0.6	0.0002
Maximum weight gain, lb	6.8±0.5	13.3±0.9	0.0001
Inotropic score	1.18±0.06	2.16±0.18	0.001
Intensive care unit stay, h	17.3±1.0	32.8±2.6	0.001
Postoperative hospital stay, d	6.5±0.1	9.2±0.3	0.003

Lazar et al. *Circulation 2004;109;1497-1502*

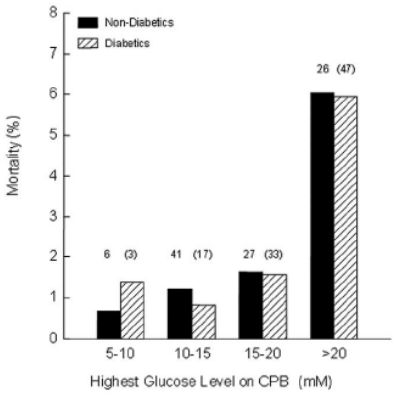

Figure 1. Peak glucose levels during cardiopulmonary bypass *(CPB)* and operative mortality in diabetic (n = 1579) and nondiabetic (n = 4701) patients operated on at our institution between January 1999 and December 2001. The *numbers at the top of the columns* indicate the percentage of patients with peak glucose levels in the respective range.

TABLE 4. Glucose as an independent predictor of outcome in patients with diabetes mellitus

Outcome variable	Odds ratio	Lower 95% CI	Upper 95% CI	*P* value
Mortality	1.20	1.08	1.32	.0005
Adverse cardiac events	NS	NS	NS	
All adverse events	1.04	1.00	1.08	.0378

Values represent odds ratios and 95% confidence intervals for 1 mmol/L changes in serum glucose levels. Adverse cardiac events: myocardial infarction, low output syndrome, death. All adverse events: stroke, infection, myocardial infarction, low output syndrome, death. *CI*, Confidence interval; *NS*, not significant.

Doenst et al. J Thorac Cardiovasc Surg 2005;130:1144-50

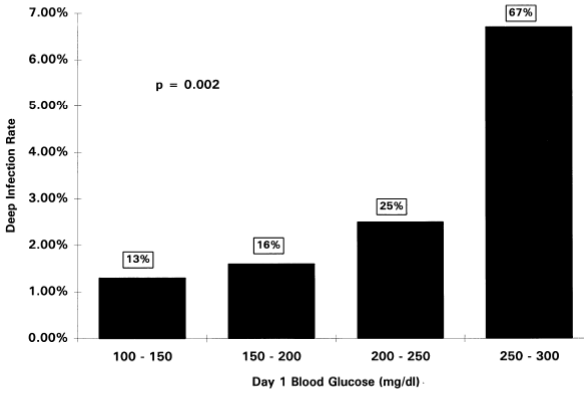

Fig 5. Significant direct relation shown between postoperative blood glucose level and deep infection rates.

Zerr K, Ann Thorac Surg 1997;63:356–61

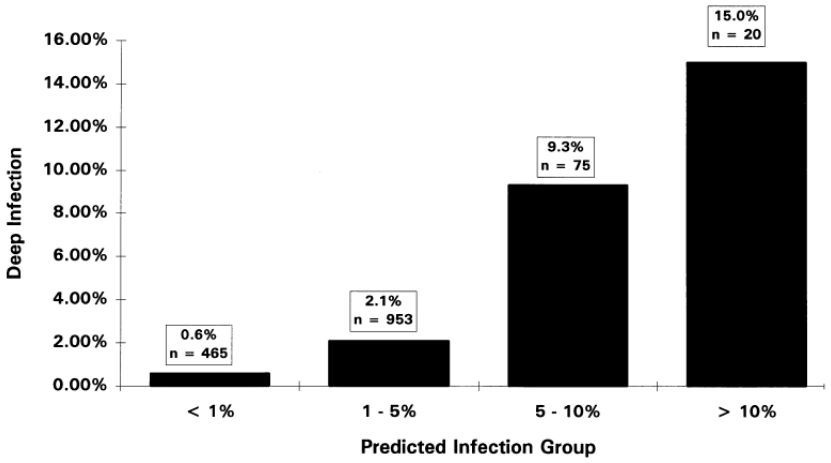

Fig 6. Reliability of the model to assign appropriate risk is shown by comparing groups according to the expected risk of infection versus actual infection rates.

Zerr K, Ann Thorac Surg 1997;63:356–61

Perioperative Glycemic Control and the Risk of Infectious Complications in a Cohort of Adults With Diabetes

Table 3—*Relative odds of any infectious complication by quartile of mean perioperative glucose concentration in 411 adults who underwent coronary artery surgery*

Glucose quartile	Model 1	Model 2	Model 3
1	1.00	1.00	1.00
2	1.09 (0.55–2.13)	1.17 (0.57–2.40)	0.94 (0.39–2.26)
3	1.68 (0.89–3.17)	1.86 (0.94–3.68)	1.59 (0.71–3.54)
4	1.37 (0.71–2.64)	1.72 (0.86–3.47)	1.78 (0.79–4.05)
P value	0.21	0.05	0.19

Data are relative odds (95% CI). Model 1 is unadjusted; model 2 is adjusted for age, sex, race, comorbidity index, APACHE score, and surgical intensive care unit stay; model 3 is adjusted for age, sex, race, comorbidity, APACHE III index, surgical intensive care unit stay, and proteinuria, and includes a 24-h lag between exposure and outcome assessment. It is limited to the 375 individuals with available data on proteinuria. *P* value is based on trend test, using mean glucose concentration as a continuous variable.

Conclusions — In patients with diabetes who undergo coronary artery surgery, postoperative hyperglycemia is an independent predictor of short - term infectious complications. Physicians should consider a glucose concentration target of <200 mg/dl to reduce the risk of infection.

Golden SH et al. Diabetes Care 22:1408–1414, 1999

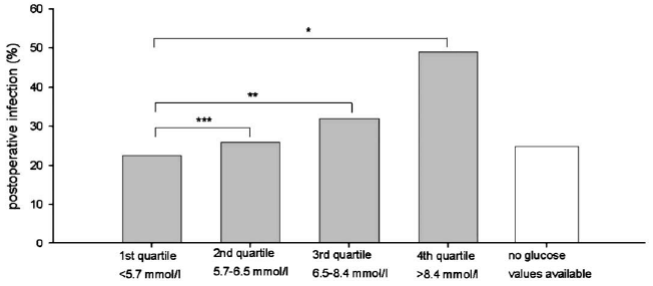

Fig. 1. Results of univariate analysis. Percentage of patients with at least one post-operative infection per post-operative glucose quartile. *P* for trend = 0.003; * *P* = 0.006; ** *P* = 0.28; *** *P* = 0.69.

Vriesendorp TM. Eur J Vasc Endovasc Surg 28, 520–525 (2004)

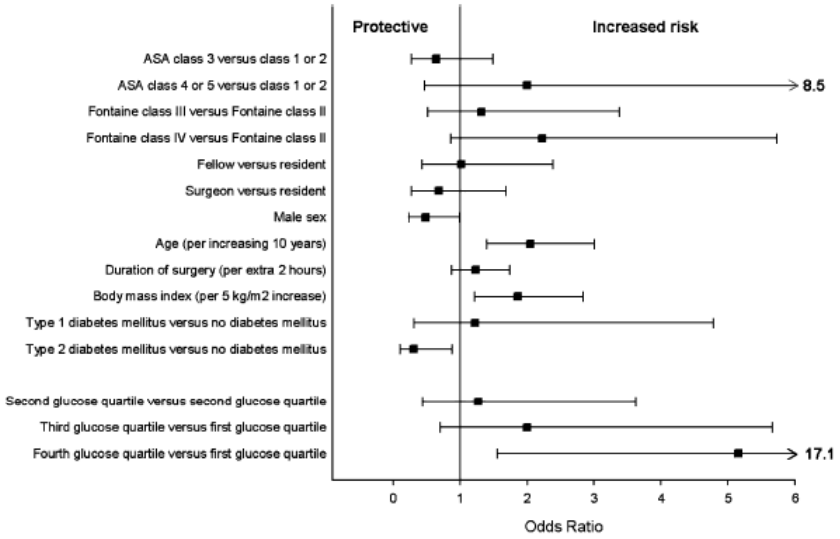

Fig. 2. Results of multivariate analysis. ASA = American Society of Anesthesiologists.

Vriesendorp TM. Eur J Vasc Endovasc Surg 28, 520–525 (2004)

Future directions

Anesthesiology 2009; 110:408–21

Perioperative Glycemic Control

An Evidence-based Review

Angela K. M. Lipshutz, M.D., M.P.H.,* Michael A. Gropper, M.D., Ph.D.†

- Controversy regarding the safety and efficacy of IIT exists, and additional RCTs are needed before definitive recommendations can be made.
- Increased interest in the role of technology in IIT: Continuous subcutaneous glucose monitoring
- Evaluation of automation of the insulin infusion protocol is also underway
- The ultimate goal of these technological advances is the creation of closed-loop glucose control.

SB in operacija

- ☐ Elektivna
- ☐ Urgentna

Metformin in perioperativno tveganje

- Operacija sama po sebi ni dejavnik tveganja za metforminsko laktacidozo, problem so perioperativni zapleti – hipotenzija, ishemija miokardna ishemija, sepsa
- Malo podatkov o metforminu in anesteziji: metf ima $t_{½}$ < 5.0 h ob normalni funkciji ledvic, večina se ga izloči v manj kot 12 h.
- Metformin ukinjamo le 24 h pred operacijo, če je potrebna splošna anestezija.
- Po operaciji ga uvedemo nazaj, ko se začne bolnik spet normalno hraniti per os, če se ni poslabšala ledvična funkcija in če ni pooperativnih zapletov.

Chan NN. Br J Anesthes 1999; 83: 631-42
Lustik. Anesthesiology 1998; 89: 266

Elektivna operacija

- Peroralna terapija – kdaj ukiniti in kdaj uvesti nazaj?
- Kaj z bazalnim insulinom
- Kako pokriti infuzijo?
- Hiperglikemija tik pred načrtovano operacijo

Urgentna operacija

- Kaj jemlje
- Kdaj je nazadnje vzel?
- Kaj in kdaj je nazadnje jedel?
- Kritje infuzij
- Perfuzor?
- Kontrole?