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**Clinical Guidelines for Perioperative Management of Diabetic Patients.**

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**Abstract:**

Surgery accompanies by high mortality and morbidity rates in diabetic patients. As this disease affects numerous systems diabetic patients require to be approached systemically and carefully. Stress of surgery stimulates catabolic hormones secretion. Perioperative assessments can help us to find the high risk diabetic patients and the patients need extra- management. Some diabetic patients need to improve blood glycemic control before surgery. Tight glycemic control is a goal in diabetic patients for developing a better outcome, while the optimal range is 110-180 mg/dl. Although a reduced protocol may be acceptable for minor surgeries in diabetic patients glucose-insulin-potassium injection should be considered for their major surgeries. Physicians' involvement with diabetic patients' management before surgery and successful perioperative management of hyperglycemia is a big challenge. A simple protocol can help physicians to develop a safe perioperative management.

**Keywords: perioperative, diabetes, insulin, glucose**

**Introduction:**

Diabetic patients constitute 12.4%-25% of the hospitalized patients.<sup>(1)</sup> Besides, surgery accompanies by high mortality and morbidity rates in diabetic pa-

tients.<sup>(2, 3, 4, 5, 8)</sup> According to the fact that a significant hyperglycemia can influence surgical outcome, studies suggest a good pre-operation glycemic control to prepare a better outcome <sup>(1, 2, 5)</sup> and an acceler-

ated wound healing.<sup>(2, 7)</sup> In this regard tight glycemic control is a goal in hospitalized diabetic patients.<sup>(1, 2, 6, 7)</sup> On the other hand, avoiding hypoglycemia is very important in the patients undergoing surgery.<sup>(8, 9)</sup> This article presents simple clinical guidelines for diabetic patients' management during perioperation, operation and post-operation period. Guidelines for risk stratification are proposed to decrease morbidity and mortality resulting from perioperative diabetic complications and hyperglycemia.

#### Effects of surgery on diabetic patients

A few challenges of mechanisms through which surgery influences perioperative management in diabetic patients are as follows: Initiated catabolic hormones secretion following surgical stress<sup>(2, 7, 9, 10)</sup>, prolonged fasting, altered consciousness and necessity of frequently checking blood sugar due to hidden hypoglycemia symptoms and altered subcutaneous insulin absorbance during surgery because of blood circulation disturbances.<sup>(2)</sup>

#### Preoperative assessments of diabetic patients

Diabetic patients should be evaluated before operation using the following checklist:

- Taking a complete history and performing an attentive physical exam<sup>(7)</sup>; asking about medications that may influence blood glucose level such as corticosteroids<sup>(1, 10, 13)</sup>, catecholamines and calcineurins which are associated with hyperglycemia and pentamidine, quinine and quinolon antibiotics which are associated with hypoglycemia.<sup>(10)</sup>
- Typing of diabetes mellitus and monitoring glycemic control.<sup>(11,</sup>

<sup>12)</sup> We can classify pre-operative risk in diabetic patients with HbA1c level. HbA1c can help to provide post-operative care and select the best protocol for blood glycemic control at time of discharge as well.<sup>(8)</sup> HbA1c value < 7% is ideal for diabetic patients before elective surgeries<sup>(5,13)</sup> while HbA1c level of persistently above 8% can probably be representative of micro vascular complications.<sup>(2)</sup>

- Assessment of diabetic complications<sup>(4, 5, 7, 8, 9, 11, 12, 13, 14, 15)</sup> including peripheral vascular, kidney, heart<sup>(12, 13)</sup>, cerebrovascular, genitourinary, eye and gastrointestinal complications<sup>(12)</sup> and an accurate assessment of cardiac autonomic neuropathy to identify high risk surgeries<sup>(13, 14)</sup>; The positive prayer sign accompanies by cervical spine immobility (stiff joint syndrome) and difficult laryngoscopy.<sup>(16, 17)</sup> Prokinetic agents and acid secretion inhibitors are administered to the patients suspicious to gastroparesis before general anesthesia to decrease acid aspiration.<sup>(14)</sup>
- Checking chest radiography<sup>(7)</sup>, electrocardiography, renal function<sup>(7, 8, 9, 11, 13)</sup> and electrolytes.<sup>(8, 9, 11, 13)</sup>
- Considering type of surgery (emergency or elective- minor or major procedure).
- Considering type of anesthesia (general or local).<sup>(8, 11, 15)</sup>

### **Blood glycemic control in perioperative period**

A blood glucose level of 110-180 mg/dl is considered as goal of glycemic control during pre-operative period.<sup>(3, 4, 9, 12, 13)</sup> Nonetheless, to prevent catabolism, starvation ketosis and insulin-induced hypoglycemia during hospitalization infusion of glucose should be considered. The physiological amount of glucose, which is 120 g/day or 5 g/h in non-diabetic adults to prevent catabolism before surgery<sup>(3)</sup> might increase to 5-10 g/h in most of diabetic patients<sup>(3, 4, 9, 14)</sup> because of preoperative fasting, surgical stress and ongoing insulin therapy. This can be given by 5 or 10% dextrose but 10% dextrose is preferred at starting rate of  $\approx 100$  ml/h.<sup>(3)</sup> More concentrated 10% dextrose can be used in fluid restriction.<sup>(3, 4)</sup>

### **Minor operations in the diabetic patients on diet therapy**

The diabetic patients on diet with good glycemic control may need no extra-treatment before surgery.<sup>(3, 7, 11)</sup> Their blood glucose level should be checked before surgery and every 1 hour during prolonged surgeries (longer than one hour). If diabetes is poorly controlled (blood glucose > 200 mg/dl), intravenous (IV) insulin should be started.<sup>(3)</sup>

### **Minor operations in the diabetic patients on drugs with good glycemic control**

Minor surgeries which take shorter than 1 hour and need a short general anesthesia<sup>(18)</sup> include laparoscopic hernia repair, dilation and curettage, cystoscopy<sup>(11)</sup>, endoscopy, jejunal biopsy and adenotonsillectomy. Patients can eat until 6 hours before surgery<sup>(18)</sup>, sulphonylureas or

insulin injection should be hold<sup>(3, 4, 5, 7, 8, 11, 18)</sup> on day of surgery<sup>(5)</sup> and metformin should be stopped 1-2 days before operation.<sup>(3, 7, 8, 11, 18)</sup> Considering that thiazolidinediones can complicate the post operative period due to fluid retention, they should be discontinued several days before surgery.<sup>(8)</sup> In diabetic patients long-acting insulin should be switched to intermediate-acting insulin 1-2 days before surgery.<sup>(3, 7, 15)</sup>

Operating diabetic patients in the morning can minimize the fasting period.<sup>(7, 9, 18, 19)</sup> If blood glucose is above 200 mg/dl<sup>(3)</sup>, it can be managed by 4-10 units subcutaneous short-acting insulin before surgery<sup>(3, 5, 18)</sup> or intravenous insulin therapy like the diabetic patients with poor glycemic control.<sup>(5, 18)</sup> Blood glucose should be checked before surgery.<sup>(3, 7)</sup>

Reduced protocols for minor surgeries are presented simply as below:

- **Diabetic patients on oral hypoglycemic agents**

-Oral hypoglycemic agents should not be taken on day of surgery.<sup>(4, 5)</sup> IV insulin therapy should be started if blood glucose level is above 180 mg/dl.<sup>(5, 18)</sup>

- **Diabetic patients on insulin**

-Short procedures, early morning  
Diabetes regimen should be delayed until after surgery and before eating.<sup>(15, 18)</sup>

- Short procedures, late morning  
2/3 total daily dose should be administered in the diabetic patients on single dose of insulin.<sup>(15)</sup>

1/2 total morning dose should be injected in the diabetic patients on 2 or 3 doses of insulin.<sup>(5, 15, 18)</sup>

-Short procedures, afternoon 1/2 total daily dose should be injected in the diabetic patients on single dose of insulin.

1/3 total morning dose should be administered in the diabetic patients on 2 or 3 doses of insulin.

-Complex procedures

IV insulin should be started.<sup>(15)</sup>

Blood glucose should be checked every hour during operation<sup>(3, 7, 11)</sup> and every 2 hours after operation.<sup>(4, 19)</sup> Oral hypoglycemic agents or subcutaneous insulin with first meal should be restarted.<sup>(3, 11, 19)</sup> Metformin should not be restarted until 72h after operation<sup>(3, 5)</sup> due to its potential association with lactic acidosis<sup>(3, 10)</sup> unless being sure about the renal function.<sup>(3, 5, 6, 14, 19)</sup>

**Major surgeries in the diabetic patients with poor glycemic control**

Patients with poor glycemic control (HbA1c > 8%) should be admitted at least the evening before surgery.<sup>(5, 18)</sup> Surgeries with general anesthesia longer than 1 hour are major surgeries.<sup>(3)</sup> Patients can eat until 6 hours before surgery<sup>(18)</sup> and operation in the morning can minimize the starvation period.<sup>(7, 9, 18, 19)</sup>

Like minor surgeries oral hypoglycemic agents and insulin injection should be held on day of surgery. Blood glucose should be evaluated before operation.<sup>(3, 7)</sup> Intravenous infusion of 10 % dextrose (500 ml bags) 100cc/hour, with 15 units insulin<sup>(3)</sup> and 5 mEq potassium chloride (KCl) added to each 500 ml bag<sup>(4, 15)</sup> should be started (Table 1). Potassium infusion is contraindicated in renal failure (creatinine >2 mg/dl) or hyperkalemia.<sup>(3, 4, 20)</sup> Blood glucose should be checked every hour during operation<sup>(3, 7, 11)</sup> and every 2 hours post operation.<sup>(4, 19)</sup>

Table 1: Insulin injection based on blood glucose level (15)

Blood glucose (mg/dl)	Soluble insulin (units) to be added to bag
<120	10
120-200	15
>200	20

Electrolytes should be rechecked post-operation<sup>(4, 9)</sup> and daily if insulin infusion continues.<sup>(4)</sup> Oral hypoglycemic agents should be restarted when eating and drinking are started.<sup>(3, 11, 19)</sup> In patient on insulin therapy, total preoperational daily dose (units) of insulin should be calculated and be divided into 3 - 4 doses in 24 hours and be given as subcutaneous short-acting insulin.<sup>(15)</sup> IV insulin infusion should be continued at least 60 minutes after the first subcutaneous insulin injection.<sup>(3, 4)</sup>

**Conclusion:**

Due to the large number of diabetic patients undergoing surgery and probable complications associated with diabetes careful perioperative evaluations and management are required in these patients. Physicians' ability to select an appropriate interventional strategy depends on the patient, the associated diabetic complications and type of surgery. Chronic diabetic complications can influence surgery and anesthetic conditions. Hence, appropriate risk stratification, optimal blood glucose and suitable interventional strategy are necessary. Tight blood glycemic control is very important in diabetic patients due to their post-operational higher mortality and morbidity rates and the optimal range of blood glucose is 110-180 mg/dl. Even the dia-

betic patients with good glycemic control will require close blood glycemic monitoring during perioperative period. Glucose-insulin-potassium infusion can minimize metabolic disturbances during surgery. The important goals in diabetic patients should be minimizing hyperglycemia and avoiding hypoglycemia during their hospitalization. It should be emphasized that successful perioperative management of diabetic patients is a big challenge and requires a simple protocol.

#### References:

1. Clement S, Braithwaite S.S, Magee M.F, Ahmann A, Smith E.P, Schafer R.G, Hirsch I.B, , et al, Management of diabetes and hyperglycemia in hospitals ,diabetes care journals,2004 Feb; 27 (2): 553-591.
2. Mcanulty G.R, Robertshaw H.J, Hall G.M, Anesthetic management of patients with diabetes mellitus, Br J Anaesth, 2000; 85 (1): 80-90.
3. Dagogo-Jack S, Alberti K.G.M, Management of diabetes mellitus in surgical patients, Spectrum diabetes journal, 2002 January; 15 (1): 44-48.
4. Marks J.B, Perioperative Management of Diabetes, American Family Physician, 2003 January; 67 (1): 93-100.
5. Smiley D.D, Guillermo E, Perioperative glucose control in the diabetic or nondiabetic patient, SMJ, 2006 June; 99 (6): 580-589.
6. Cook E.A, Cook J.J, Rosenblum B.L, How to achieve optimal perioperative glycemic control in patients with diabetes, Podiatry Today, 2006 DEC, 19 (12): 14-21.
7. Plodkowski R.A, Edelman S.V, Pre surgical evaluation of diabetic patients, Clinical diabetes, 2001; 19 (2): 92-95.
8. Meneghini L.F, Perioperative management of diabetes: Translating evidence into practice, Cleveland clinic journal of medicine, 2009 November; 76 (Suppl 4): S53-S59.
9. Hirsch I.B, McGill J.B, Cryer P.E, White P.F, Perioperative management of surgical patients with diabetes mellitus, Anesthesiology, 1991; 74: 346-359.
10. Wesorick D, Malley C, Rushakoff R, Larsen K, Magee M, Management of diabetes and hyperglycemia in the hospital: a practical guide to subcutaneous insulin use in the non critically ill, adult patient, Journal of hospital medicine, 2008; 3 (5): S17-S28.
11. Schiff R.L, Welsh G.A, Perioperative evaluation and management of the patient with endocrine dysfunction, Medical Clinics of North America, 2003 January; 87 (1): 1-15.
12. American Diabetes Association, Standards of medical care in diabetes, diabetes care, 2007 January; 30 (1): S4-S41.
13. Glister B.C, Vigersky R.A, Perioperative management of type 1 diabetes mellitus, Endocrinol Metab clin N Am, 2003; 32: 411-436.
14. Gautam A, Baluch A, Kaye A, Frost E.A.M, Modern strategies for the anesthetic management of the patient with diabetes, M.E.J. Anesth, 2009; 20 (2): 187-197.
15. Jacobson S.J, Sowers J.R, An Update on Perioperative management of diabetes, Arch Intern Med, 1999 Nov; 159: 2405-2411.
16. Erden V, Basaranoglu G, Delatioglu H, Hamzaoglu N.S, Relationship of difficult laryngoscopy to long term non insulin dependent diabetes and hand abnormality detected using the prayer sign, BJA, 2003; 91 (1): 159-160.
17. George S.P, Jacob R, Predictability of airway evaluation indices in diabetic patients, Indian J. Anaesth, 2003; 47 (6): 476-478.
18. Betts P, Brink S, Silink M, Swift P.G.F, Wolfsdor J, Hanas R, Management of children and adolescents with diabetes requiring surgery, Pediatric diabetes, 2009; 10 (12): 169-174.
19. Rhodes E.T, Ferrari L.R, Wolsdorf J.I, Perioperative management of pediatric surgical patients with diabetes mellitus, Anesth Analog, 2005; 101: 986-999.
20. The Creat-Ecla trial group investigators, Effect of glucose-Insulin-Potassium infusion on mortality in patients with acute ST-segment elevation myocardial infarction, JAMA, 2005; 293: 437-446.