Stress Response to Surgery Under General Anesthesia in Type 2 Diabetic Patient

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- Central Location
- 700-bed multidisciplinary hospital
- Very large OPD (4500 patients /day)
- 60-70 diabetic patients under went operative procedure everyday
- WHO Collaborating Centre for Research on Diabetes and its complications (Till 2014)
Uniqueness of BADAS

- One of Largest diabetes care provider in the world
- One of Largest non-profit health care network outside Govt. in the world
- Provide healthcare through a network of hospitals & educational institutions of its own
Our network all over the country
Diabetes Mellitus

• One of the major chronic diseases affecting mankind all over the world

• It has been declared as an epidemic in developing countries by both the World Health Organization and International Diabetes Federation
Killer Facts:

- More than **382 million (8.3%)** people live with diabetes – by 2035 will be **592 (9.9%)** million
- **80%** live in low- and middle-income countries (LMCs)
- **4.6 million** deaths each year
- Every **8 seconds**, someone in the world dies from diabetes
Diabetes in Bangladesh

- The estimated prevalence of diabetes in Bangladesh is around 6.8%

- Mostly Type 2 diabetes (99%)
Fifty percent of all diabetic patients present for surgery during their lifetime.
Inevitably, diabetic patients presenting for incidental surgery, or surgery related to their disease, will place an increasing burden on anesthetic services.
Perioperative morbidity and mortality are greater in diabetic than in nondiabetic patients.
In response to stress during surgery and anesthesia- the biochemical parameters like stress hormone being altered
The neuroendocrine system comes into play to maintain fuel requirements by glycogenolysis and gluconeogenesis through stress hormones catecholamines, glucagon, cortisol, and growth hormone.
The endocrine hormones like cortisol, thyroxin, glucagon, and growth hormone are released due to surgical stress under hypothalamopituitary control.
Surgery elicits a stress response that is directly proportional to the degree of tissue trauma.
Why Stress response to surgery under anesthesia **is complicated** in diabetic patients?

- Insulin deficiency
- Counter regulatory hormones activity
- Autonomic neuropathy
- Electrolytes transport
- Preoperative fasting states
- Dehydration
These lead to abnormal metabolism of carbohydrate, protein and fat as well as electrolyte imbalance
Anesthesia also principally affects glucose metabolism through the modulation of sympathetic tone.
Our study

• It was designed to explore the metabolic and stress response to lower abdominal surgery under general anesthesia in type 2 diabetic subjects with particular focus on
  – Serum glucose
  – C-peptide
  – Cortisol
  – Electrolytes

• It also investigated the stress response in different treatment variability
OBJECTIVES

• To investigate the glycemic response to surgery in type 2 diabetic subjects under general anesthesia.

• To investigate the serum cortisol response to surgery in type 2 diabetic subjects under general anesthesia.
OBJECTIVES

• To investigate the stress response in insulin and combined insulin-OHA treated type 2 diabetic subjects during surgery under general anesthesia.

• To investigate the stress response in hypertensive and normotensive type 2 diabetic subjects during surgery under general anesthesia.
Study design

The study was a cross sectional prospective study
Study subjects

100 subjects who were admitted in BIRDEM hospital in fit physical condition (ASA Class II) were received total abdominal hysterectomy under general anesthesia
Exclusion criteria

- Influencing variable like patients taking steroid or analgesics
- Pre operative plasma glucose <5 mmol/l and >10 mmol/l
- Patients of ASA Class III, IV, V and E
- Obese and malnourish
Design of general anesthesia

- Induction: Thiopental, fentanyl, vecuronium
- Maintenance: Halothane, nitrous oxide with oxygen
Sample collection

Three samples (8-10 ml) were collected

– The first sample- just before anesthesia
– 2nd sample- 10 minutes after incision
– 3rd sample- 10 minutes after extubation
Control

First sample of each subject were served as a control
ANALYTICAL METHODS

• Plasma glucose was measured by glucose oxidase method (Randox, UK).
• Serum electrolytes were measured by Dry Chemistry method (DT-60, USA).
• Serum C-peptide was measured by chemiluminescent immunoassay (Immulite, USA).
• Serum cortisol was measured by chemiluminescent immunoassay (Immulite, USA).
Statistical analysis was performed using SPSS (Statistical Package for Social Science) software for Windows version 17 (SPSS Inc., Chicago, Illinois, USA).
RESULTS AND OBSERVATIONS
Figure: Perioperative glycemic and insulinemic status of the study subjects
Figure: Perioperative serum cortisol status of the study subjects
Figure: Perioperative serum electrolytes level of the study subjects
Figure: Perioperative glycemic and insulinemic status of insulin and insulin-OHA treated subjects
Figure: Perioperative serum cortisol status of insulin and insulin-OHA treated subjects
Serum Na$^+$ (mmol/l)

Serum K$^+$ (mmol/l)

Figure: Perioperative serum electrolytes status of insulin and insulin-OHA treated subjects.
Figure: Perioperative glycemic and insulinemic status of hypertensive and normotensive study subjects
Figure: Perioperative serum cortisol status of hypertensive and normotensive study subjects.
Figure: Perioperative serum electrolytes status of hypertensive and normotensive study subjects
The data lead to following conclusions

1. Lower abdominal surgery under general anesthesia in well controlled type 2 diabetic subjects is accompanied by a hyperglycemic response which results from rise of insulin antagonists like cortisol rather than fall of insulin secretion.
The data lead to following conclusions

2. Insulin treatment alone is more effective than insulin-OHA combination to control blood glucose in type 2 diabetic subjects undergoing surgery under general anesthesia; but the two treatment modalities lead to similar cortisol response.

3. Coexisting hypertension is associated with insulin hyposecretion leading to hyperglycemia in type 2 diabetic patients undergoing surgery under general anesthesia.
RECOMMENDATIONS

1. Insulin rather than insulin-OHA may be a good choice of treatment for preoperative glycemic control.

2. Special attention should be given regarding perioperative glycemic control in type 2 diabetic coexisting hypertensive patients.
RECOMMENDATIONS

3. Other stress hormones like glucagon, catecholamines, growth hormone and heat shock proteins may be measured for better quantification of the surgical stress.

4. To reduce the stress response—premedication and other anesthetic drugs, by increasing the dose of same anesthetic agents or anesthetic procedure may be applied for better management of type 2 diabetic subjects.
THANK YOU