Original Article

Impact of elevated glycosylated hemoglobin on hospital outcome and 1 year survival of primary isolated coronary artery bypass grafting patients

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ABSTRACT

Objective: It is unknown whether adequacy of diabetic control, measured by hemoglobin A1c, is a predictor of adverse outcomes after coronary artery bypass grafting.
Methods: From December 2013 to November 2015, 80 consecutive patients underwent primary isolated CABG surgery at national heart institute, their data were prospectively collected and they were classified according to their HbA1c level into two groups, Group (A): Forty patients with fair glycemic control (HbA1c below or equal to 7%), Group (B): Forty patients with poor glycemic control (HbA1c above 7%). Hospital morbidity, mortality and one year survival were examined in both groups. Telephone conversation was used to call patients or their relatives to determine the one year survival and it was 100% complete. This study had gained the ethical approval from national heart institute ethical committee.
Results: In-hospital mortality for group A was 2.5% (one patient) and 7.5% (3 patients) for group B with no statistical significance. One year mortality was (5.13%) (2 patients for group A) and (8.11%) (3 patients) for group B with no statistical significance. As regard the morbidity there was no statistical significance between the two groups in the incidence of neurological complications whether stroke or coma, atrial fibrillation, postoperative myocardial infarction, low cardiac output syndrome, heart failure, renal failure, need for dialysis, deep sternal wound infection, and readmission. However, group B had lengthy hospital stay, lengthy ventilation hours, more respiratory complications, and more superficial wound infection with a statistical significance when compared to group A, P values were 0.003, 0.003, 0.038, 0.044 respectively.
Conclusions: This study showed that HbA1c is a good predictor of in-hospital morbidity. It worth devoting time and effort to decrease HbA1c level below 7% to decrease possible postoperative complications.

1. Introduction

Diabetes mellitus (DM) is known to be a risk factor for the development and progression of cardiovascular disease (CVD). 55% of the diabetic population have coronary artery disease (CAD). It is well known that diabetes is a major independent risk factor for IHD after adjustment for other risk factors such as age, hypertension, hypercholesterolemia, and smoking.[1] Approximately from all coronary artery bypass grafting (CABG) population, 20% of

them have DM. Thus, diabetic patients undergoing this operation represent a large and complex patient population.[1]

In 2011, the World Health Organization advocated the use of HbA1c in diagnosing diabetes. Irrespective of previous diabetic status, elevated HbA1c acts as a strong predictor of both morbidity and mortality. In particular, it was estimated that the mortality risk for CABG is quadrupled at HbA1c levels >8.6%. In elective situations, these patients should be delayed for surgery until adequate levels of HbA1c which reflects proper glycaemic control is achieved.

The predictive value of HbA1c had been investigated on short-term outcomes in well-controlled diabetes in some recent studies.[2] HbA1c reflects a patient's glucose control during the preceding

3–4 months. According to Current practice guidelines of the American Diabetes Association,[3] current recommendations suggest that patients with diabetes aim to achieve HbA1c levels of at least less than 7%.[4–6] This study will show whether or not HbA1c, the standard measure to assess long-term glucose control, is a potential risk factor for adverse outcomes in patients undergoing CABG.

2. Materials and methods

From December 2013 to November 2015, 80 consecutive patients underwent primary isolated CABG surgery at National Heart Institute, their data were prospectively collected and they were classified according to their HbA1c level into two groups,

Group (A): Forty patients with fair glycemic control (HbA1c below or equal to 7%).

Group (B): Forty patients with poor glycemic control (HbA1c above 7%). Patients of group B were operated upon semiurgently because of left main disease or successfully treated unstable angina after weaning from IV medications and all of them were stable enough for discharge but having no time to correct HbA1c fully.

2.1. The inclusion and exclusion criteria of the study groups were

2.1.1. Inclusion criteria
Adult patients undergoing elective first time CABG surgery in cases of:

(1) Multi-vessel coronary artery disease.
(2) Left main disease.
(3) One or two coronary vessel disease.

2.1.2. Exclusion criteria
Adult patients with the following diseases:

(1) Patients with multiple preoperative co-morbidities (liver failure, renal failure, respiratory failure and advanced malignancy).
(2) Patients with history of previous cerebro-vascular disease.
(3) Patients with concomitant Valvular heart disease

2.2. Operative technique

2.2.1. Anesthesia
Before surgery all preoperative medications were continued until the morning of surgery except for angiotensin-converting enzyme inhibitors and angiotensin 2 receptor blocker. They were discontinued at the night of surgery. Acetylsalicylic acid was discontinued 5 days before surgery, clexane 12 h before operation and plavix from 5–7 days before operation. Moreover, all patients were pre-medicated with oral valium (5 mg) at the night of surgery then intramuscular Morphin (l0 mg) at the morning of surgery and intravenous midazolam (0.1 mg/kg) at the operating room.

After admission to the operating room, patients were monitored with five-lead electrocardiogram (leads ii and v simultaneously), pulse oximetry, invasive arterial blood pressure using an arterial catheter connected to a pressure transducer, capnography, central venous catheter inserted in the internal jugular vein, nasopharyngeal temperature probe, urinary catheter and frequent arterial blood gases measurements.

After pre-oxygenation, general anesthesia was induced with thiopental (3–5 mg/kg), Fentanyl (2–10 mg/kg) and pancuronium (0.1 mg/kg). Patients were then ventilated manually with face mask and intubated with an oral cuffed endotracheal tube with the proper diameter, followed by the onset of controlled mechanical ventilation.

Anesthesia was maintained with isoflurane and additional doses of propofol infusion, fentanyl (1–2 ugm) and pancuronium (0.01 mg/kg). Anticoagulation was established with an initial dose of heparin (300–400 IU/kg) and to get activated clotting time (ACT) high than 400 s., additional heparin was given on need to maintain ACT higher than 400 s. during bypass time.

2.2.2. Surgery
All patients were operated via median sternotomy and cardiopulmonary bypass with aorto-caval cannulation. Heart was cross clamped and plegied by warm blood intermittent antegrade cardioplegia. Left internal mammary artery was anastomosed to left anterior descending artery. Reversed saphenous vein was anastomosed to other target vessels. Patients were subjected to perioperative tight glycemic control using uniform intravenous insulin infusion protocol (target blood glucose level below 150 mg/dl). Patients were compared regarding morbidity and mortality. Also, one year survival was compared.

All patients were treated with a uniform perioperative intravenous insulin protocol. In the operating room, an insulin infusion was prepared by mixing 100 units of insulin with 50 mL 0.9% normal saline. Routine measurement of blood glucose was obtained from serial arterial blood samples measured every 15 minutes.

In the intensive care unit, glucose levels were obtained from arterial blood samples or finger stick samples every 2 h. Patients received a continuous insulin infusion that was adjusted to maintain blood glucose below 150 mg/dl. Once patients were transferred to the floor, blood glucose values were obtained every 4 to 6 h. The insulin infusion was initiated only for blood glucose more than 200 mg/dL and adjusted to target of blood glucose below 150 mg/dL. If level is below 200 mg/dl, blood glucose management was variable and includes combination of scheduled subcutaneous insulin therapy, and repeated insulin injections according to Matias protocol.

3. Results

Demographic criteria of the two groups are listed in Table 1 that demonstrates that the incidence of left main disease and dysnea was higher in group B (HbA1c above 7%) with p value of 0.022 and 0.043 respectively.

In this study, the incidence of left main disease is higher in group B (37.5%) compared to (15%) of group A, p value of 0.02, owing to the fact that most of them needs semiurgent surgery leaving less chance of better glycemic control preoperatively. Therfore, surgery had not been canceled because of high hbA1c, but little time was given to correct blood sugar tightly aiming at blood glugose level less than 150 mg/dl for all in hospital transfer patients before surgery. This group was successfully treated from ACS in the form of unstable angina or had a critical anatomy of LMD along with their symptoms.

The operative details of the studied groups are also listed in Table 1 that shows introperative difficulty in controlling blood glucose level in group B compared to group A both during and after cross clamp time. This led to a significant increase in cardiopulmonary bypass and total operative times in group B, p value of 0.000 and 0.003 respectively. Moreover, the incidence of intraoperative acidosis was significantly higher in group B and was more difficult to control. In this study acidosis was considered persistent when metabolic acidosis was not responding to usual measures of treatment such as Na Hco3 and this in turn could lead to cardiac arrhythmais and decreased response to inotropes like epinephrine.

In this study all patients received insitu pedicled LIMA to LAD except for one patient in group B due to inadvertent injury to LIMA conduit that had been replaced by reversed saphenous vein graft to