Volume 20 Issue 32
Originally issued as F6

Global Journal of Medical Research: F
Diseases
Volume 20 Issue 6 Version 1.0 Year 2020
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

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Abstract- Coronary artery disease (CAD) is one of the leading causes of morbimortality worldwide. In patients with diabetes mellitus type 2 (DM2), CAD is more likely to be a complex disease and often requires cardiac surgery. Furthermore, perioperative blood glucose levels control is associated with the followingoutcomes: surgery success, mortality, and infection postoperative. This is a retrospective study, we have collected data form, 43 patients, between 2015 and 2017, with diabetes type 2 and who had passed through a Coronary Artery Bypass Grafting. Those with infection postoperative had a glycohemoglobin 7, 9 (SD ±1,4), and those without infection had an HbA1c 7, 25 (SD ±0,94) and a p-value from 0,039. Adding this was identified that the average of creatinine clearance in patients with the infectious disease was 59 (SD ±21, 3) and 67 (SD ±26) in those without infection, calculated a p-value from 0,039. High levels of Hb1Ac are a predictor of infection disease postoperative.

Keywords: diabetes mellitus;coronary disease; cardiovascular surgical procedures; cross infection; glycated hemoglobin A.

GJMR-F Classification: NLMC Code: WD 200



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HbA1c as a Predictor of Postoperative Infection in Type 2 Diabetic Patients after Coronary Artery Bypass Grafting

Patricia Veloso Facury Lasmar Ferreira [α], Wagner José Martorina [σ] & Bruno Bastos Godoi [ρ]

Abstract- Coronary artery disease (CAD) is one of the leading causes of morbimortality worldwide. In patients with diabetes mellitus type 2 (DM2), CAD is more likely to be a complex disease and often requires cardiac surgery. Furthermore, perioperative blood glucose levels control is associated with the followingoutcomes: surgery success, mortality, and infection postoperative. This is a retrospective study, we have collected data form, 43 patients, between 2015 and 2017, with diabetes type 2 and who had passed through a Coronary Artery Bypass Grafting. Those with infection postoperative had a glycohemoglobin 7, 9 (SD ±1,4), and those without infection had an HbA1c 7, 25 (SD ±0,94) and a p-value from 0,039. Adding this was identified that the average of creatinine clearance in patients with the infectious disease was 59 (SD ±21, 3) and 67 (SD ±26) in those without infection, calculated a p-value from 0,039. High levels of Hb1Ac are a predictor of infection disease postoperative. Thereby, patients with coronaropathy must have glucose levels, mainly HbA1c levels, and renal function evaluated before cardiac surgery, to obtain a lower risk of postoperative infectious complications.

Keywords: diabetes mellitus;coronary disease; cardiovascular surgical procedures; cross infection; glycated hemoglobin A.

I. Introduction

One of the leading causes of morbimortality worldwide is coronary artery disease (CAD), which has many risk factors in the pathophysiology of the issue, which is why the forerunning risk factor is diabetes mellitus type 2(DM2) [1].In patients with DM2, CAD is more likely to be a complex disease characterized by small, diffuse, calcified, multivessel disease and often requires coronary revascularization [2,3].

Many clinical trials[1,2,4–8] have demonstrated that postoperative myocardial infectious complications in patients with DM2 are associated with the following conditions: blood glucose control, length of stay in the hospital, or in the intensive unit care (ICU), renal failure and previous lung disease [8,9].

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The current study evaluates which variables are associated with a significant risk of hospital infection of any nature in patients with DM2. The central hypothesis is that preoperative blood glucose level, and HbA1c on in-hospital outcomes, principally associated with infections after CABG.

II. Methodology

This is a transversal study; we have collected data between 2015 and 2017 from all patients with type 2 diabetes who passed through a Coronary Artery Bypass Grafting. During this period, CABG performed in 43 patients with DM2. This number has reached because of inclusion criteria: 1) patients who would pass through a cardiac surgery, 2) patients diagnosed with DM2, 3) patients under the care of endocrinology staff. And the exclusion criteria were faulting data at the medical records of those patients. Moreover, were collected the following records: gender, age, HbA1c level, time diabetic diagnosed, insulin user (yes or not), time-elapsed in hospital and the ICU, smoking history, pulmonary disease, and infection postoperative. The Ethical Committee in Research approved this study by the BIOCOR hospital.

III. Statistical Analysis

The chi-square test used in categorical variables (for example, presence or absence of lung disease, use of insulin or not, etc.), with the p-value calculated by the person's square. In the univariate analysis, the continuous numerical variables, when in the standard distribution in the course of Gauss, were analyzed by the T-test of independent samples. And, when not parametric, they were analyzed by the Mann Whitney U test.

IV. Results

Were collected data from 43 patients with DM2 that passed through a CABG for myocardial revascularization. The average age was 65, an average of 8 years diagnosed with DM2 (standard deviation of 8,8), and from all, only 34,8% used insulin to treat and normalize glucose levels (Table 1).

Moreover, were identified an average of glycohemoglobin of 7, 4. Furthermore, 14, 6% of the

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patients had some type of infectious disease after CABG.

Table 1: Characteristics of the patients about each variable

Variables	N (%) or median (Quartile 25-75%) or average (SD)
Age (years)	65 (± 9,3)
Female	17 (39,6%)
Glycohemoglobin (%)	7,40 (±1,08)
Length of DM2 (years)	8 (±8,8)
Length of hospital stay until surgery(days)	5 (±8,8)
Drain time in UCI (days)	1
Length of stay in UCI (days)	2 (±1,5)
Creatinine clearance (mL/min)	67 (±25,5)
Presence of infectious disease after CABG	8 (14,6%)
Use of insulin before hospitalization	15 (34,8%)
Smoking	3 (7,3%)
Pulmonary disease	8 (19,5%)

Those with infection postoperative had a glycohemoglobin 7, 9 (SD ±1,4), and those without infection had an HbA1c 7,25 (SD ±0,94) and a p-value from 0,039 (graphic1).Adding this was identified that the average of creatinine clearance in those patients with the infectious disease was 59 (SD ±21,3) and 67 (SD ±26) in those without infection, calculated a p-value from 0,039 (table 2).

Table 2: Characteristics of patients into two groups: absence and presence of infectious disease postoperative and the p-value of each one

Variables	Absence of infectious disease	Presence of infectious disease	p- value
Average age (years)	65 (± 9,32)	65 (± 8,9)	0,059
Female	15 (34,8%)	2 (4,6%)	0,51
Glycohemoglobin (%)	7,25 (±0,94)	7,9 (±1,4)	0,039
Length of DM2 (years)	8 (±8,98)	10 (±9)	0,057
Length of hospital stay until surgery (days)	6,7 (1,5-8)	12,8 (4 – 25)	0,223
Drain time in UCI (days)	1	1	1
Length of stay in UCI (days)	2 (±1,5)	2 (±1,7)	0,062
Creatinine clearance (mL/min)	67 (±26)	59 (±21,3)	0,039
Use of insulin prior to hospitalization	11 (30,6%)	4 (57,1%)	0,177
Smoking	2 (5,7%)	1 (16,7%)	0,341
Pulmonary disease	28 (82,9%)	5 (71,4%)	0,482

V. Discussion

This study has shown that high levels of Hb1Ac and low levels of creatinine clearance are a predictor of infection disease post CADG.

Izadi, *et al.* (2014)[19] have demonstrated that immunosuppression induced by hyperglycemia-ketoacidosis can be considered as the precedent factor in patients with DM2 to infection, principally after CADG[1,5,13,18,19]. Comparatively, our study showed high levels of infection disease postoperative in patients with previous uncontrolled Hb1AC.

It is controversial what glycemic parameter used as a predictor of postoperative infection disease after CABG. Some authors defend tight blood glucose control as a decreasing factor of morbidity, mortality, and lower rates of infection after cardiac surgeries, principally associated with blood glucose < 200 mg/dL, and <139mg/dL if in ICU. Others defend a more straight target of blood glucose (81 to 108 mg/dL) [1,7,9,12,24]. Other researchers advocate that patients with HbA1c lower than 7% have a better outcome than patients with poorly controlled diabetes (HbA1c> 7%)[13], which also demonstrated with our results that those patients with infectious disease had an HbA1c> 7,9.

Also, patients with HbA1c lower than 7% had similar outcomes compared to those without diabetes diagnosis [16,18,25]. This can corroborate with Halkos *et al.* (2008)[16], demonstrating a significant increase in in-

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hospital mortality, renal failure, cerebrovascular accident, deep sternal wound infection, and a composite index of infection in those patients with HbA1c levels higher than 7%. So then, preoperative glycosylated hemoglobin emerges as a predictor of mortality and principally infections postoperative after CABG [16].

Another variable as a predictor of postoperative infection is the creatinine clearance (CrCl). As shown by Kassaian*et al.* (2012)[18] and Halkos *et al.* (2008)[16], CrCl, as HbA1c levels, predict infection disease postoperative [7,8,12,26,27]. We have also shown similar results. In all patients with infection after CAGD, the CrCl was lower than 59, with a p-value of 0,039.

There are potential limitations in our study that needs to mention. First, it designs retrospective research. Second, this was a single-center experience, and larger multi-center studies should confirm our findings. Third, multivariable analysis was not made, so independent associations cannot be summarized from this study.

VI. Conclusion

In summary, high levels of Hb1Ac are a predictor of infection disease post CADG. Thereby, patients with coronaropathy must be the glucose levels, and mainly HbA1c levels, evaluated before cardiac surgery. Moreover, creatinine clearance should also be evaluated to predict poor outcomes postoperative in patients with DM2.

These findings demonstrate that it is quite essential a holistic medical evaluation in patients with DM2 before cardiac surgeries, focusing on the glucose levels control, HbA1c, and renal function to obtain a lower risk of postoperative infectious complications.

Further researches must be developed to evaluate, prospectively, with a biggersample, a significant association between HbA1c and postoperative infection in patients with DM2 submitted through a CABG.

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