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Glycemic control disorders while acute cardiovascular events in a Moroccan population

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ABSTRACT

There is a two-way relationship between type 2 diabetes and heart diseases. This is the background to our work wich its primary objective was to study the prevalence of glycoregulation disorders in diabetic and non-diabetic patients hospitalized for acute cardiovascular events and secondary objectives were to study the link between glycemic status and severity parameters, notably NT-Pro-BNP levels and left ventricular ejection fraction. This is a prospective monocentric analytic study of patients with acute cardiovascular events admitted to the cardiology department of the Sheikh Khalifa Ben Zayed Al Nhayan Hospital in Casablanca and the polyvalent intensive care unit department of the Mohamed VI International University Hospital from January to December 2023. The number of patients was 95, The most frequent diagnosis was acute cardiac decompensation. 50.5% of patients were diagnosed diabetics, 29% prediabetics and 14% unrecognized diabetics. Our study showed no correlation between HbA1c or blood glucose levels on admission and the number of cardiovascular events. we found no significant correlation between NT-proBNP levels, left ventricular hypertrophy, left ventricular ejection fraction and glycoregulatory disorders. The early introduction of screening for abnormalities in glycemic regulation offers several potential advantages.

1. INTRODUCTION

The link between the presence of diabetes and the incidence of heart disease, particularly ischemic heart disease and heart failure, is well known, but the emergence of glycemic regulatory abnormalities in the acute phase of heart disease is a more recent development [1]. In non-diabetic patients, glymoregulatory disorders increase cardiovascular risk, and in-hospital mortality is higher in myocardial infarction patients with elevated blood glucose levels [2].

This is the background to our work, whose primary objective was to study the prevalence of glycoregulation disorders in known diabetic and non-diabetic patients hospitalized for acute cardiovascular events.

Secondary objectives were to study the link between glycemic status and severity parameters, notably NT-Pro-BNP levels and left ventricular ejection fraction.

Techniques:

This is a prospective monocentric analytic study of patients with acute cardiovascular events admitted to the cardiology department of the Sheikh Khalifa Ben Zayed Al Nhayan Hospital in Casablanca and the polyvalent intensive care unit department of the Mohamed VI International University Hospital.
Our study lasted 12 months from January 2023 to December 2023.

Data collection method and variables analyzed

Data analysis was performed using SPSS 20.0 software. First, we performed a descriptive analysis of patients' sociodemographic and clinical characteristics. Quantitative variables were described in terms of means, while qualitative variables were described in terms of numbers and percentages. Inferential statistical techniques were used to study the relationship between the different variables. For cross-tabulation of categorical variables, we used the Chi-square test of homogeneity, or Fisher's exact test if the conditions for applying Chi-square were not valid. We also used mean comparison tests if one of the variables was quantitative. In this case, we used the Student's t test if the variances were homogeneous, or the non-parametric Mann-Withney test. The IBM SPSS Statistics 20 program (IBM Corp, Armonk, NY, USA) was used for statistical analyses, and $p < 0.05$ was considered the limit of statistical significance.

Definition of variables:

Socio-demographic variables: Patient age was divided into two groups, patients aged 40 to 60 and patients aged over 60.
Diabetes and prediabetes were defined by the American Diabetes Association 2023 criteria [3].
Left ventricular ejection fraction (LVEF) has been defined according to European recommendations: preserved LVEF > 50%, reduced LVEF < 40%, between 40% and 50% and LVEF is said to be moderately impaired [4].
In people aged <70 years, the 10-year risk of fatal and non-fatal cardiovascular disease was calculated using the SCORE2 scale. This score is calibrated according to geographic region and gender, and gradates risk as low (<5%), moderate (5 to <10%), high (10 to <20%) or very high (≥20%) [5].
In people ≥ 70 years of age an estimate of fatal and non-fatal 10-year SVR was calculated using the SCORE2-OP scale [6].
NT Pro BNP was defined in three groups, below 125 pg/ml, between 125 and 300 pg/ml, and above 300 pg/ml [7].

Effects:

The number of patients was 95. Sex ratio was 3M/1F. The most frequent diagnosis was acute cardiac decompensation. Socio-demographic, clinical ans biological criteria are presented in [Table 1].
Our study showed that 50.5% of patients were diagnosed diabetics, 29% prediabetics and 14% unrecognized diabetics. The prevalence of glycemic dysregulations in non-diabetic patients was 37% based on admission blood glucose (Glycemia above 1,26 g/l).

Tableau 1: Socio-demographic, clinical and biological criteria of patients. Abbreviations: ACS ST+(acute coronary syndrome ST +, ACS ST-:Acute coronary syndrome ST-, CVR: cardiovascular risk

Criteria	Number	Percentage
Gender :Female	23	24
Male	72	76
Age 40-60	14	14.7
>60	81	85.3
Diagnostic : Acute Decompensation	55	57.9
ACS ST+	23	24.2
ACS ST-	17	17.9
Diabetes	48	50.5
Category CVR : Moderate	6	6.3
High	16	16.8
Very High	73	76.8
Fasting glycemia on admission (g/l)		
<1	5	5.3
1-1.26	11	11.6
1.26-1.99	36	37.9
>2	43	45.3
Glycated hemoglobin(%)		
<5.7	14	14.7
5.7-6.4	28	29.4
6.5-7	12	12.6
7-9	25	26.3
≥ 9	16	16.8
Nt-ProBnp		
<125	6	6.3
125-300	6	6.3
>300	80	84

The correlation between Glycated hemoglobin (HbA1c) and diagnosis, biological factors and ultrasound criteria was investigated in [table2]

Table 2: Correlation study between glycated hemoglobin and biological and echocardiographic factors.
Abbreviations: LVD (left ventricular dilatation)

Glycated Hemoglobin(%)	< 5,7	5,7–6,4	6,5 – 7	7 – 9	≥ 9

Diagnostic : Acute Decompensation	7	16	9	15	8	
ACS ST+	4	8	0	4	7	0.281
ACS ST-	3	4	3	6	1	
NTproBNP						
< 125	1	3	0	1	1	
125–300	1	0	1	2	2	0,883
> 300	11	24	11	21	13	
LVD: Yes	8	9	6	5	8	0.09
No	6	18	5	20	8	
LVEF						
>50%	5	9	2	12	6	
40-49%	3	8	4	5	4	0.864
<40%	6	11	6	8	6	
Pulmonary hypertension	5	10	8	6	8	0.124
Oui	9	18	4	19	8	
Non						
Category CVR : Moderate	1	2	1	0	2	
High	2	8	3	2	1	0.322
Very High	11	18	8	23	13	

The link between level of glycemia on admission and diagnosis, biological factors and ultrasound criteria was investigated in [table3]

Table 3: Correlation study between level of glycemia on admission and biological and echocardiographic factors

Level of glycemia on admission	**< 1**	**1 - 1,25**	**1,26 – 1,9**	**≥ 2**	**P**
Diabetes					
No	3	8	22	14	0.024
Yes	2	3	14	29	
Diagnostic :					
Acute Decompensation	4	6	19	26	

ACS ST+	1	3	9	10	0.911
ACS ST-	0	2	8	7	
NTproBNP					
< 125	0	2	1	3	
125–300	0	0	1	4	0.676
> 300	5	9	31	35	
Left ventricular dilatation:					
Yes	2	8	23	24	0.541
No	3	3	12	18	
LVEF					
>50%	0	6	14	14	
40-49%	2	1	9	12	0.488
<40%	3	4	13	17	
Pulmonary hypertension	3	4	15	15	0.712
Oui					
Non					
Category CVR :					
Moderate	0	0	4	2	
High	1	2	9	4	0.347
Very High	4	9	23	37	

Dialogue:

The pathogenesis of cardiovascular disease in diabetic patient may involve macrovascular changes, endothelial cell dysfunction and accelerated atherosclerosis. This leads to an increased risk of plaque rupture, thrombus formation and, ultimately, vessel occlusion [8].

50.5% of patients were diagnosed diabetics, 29% prediabetics and 14% unrecognized diabetics

Our study showed no correlation between HbA1c or blood glucose levels on admission and the number of cardiovascular events, in contrast to a Swedish study of 83,021 patients which established a linear correlation between HbA1c levels and the risk of cardiac decompensation. Indeed, the incidence of cardiac decompensation was 13.8% in patients with HbA1c levels below 6%, compared with 25.8% in those with HbA1c levels above 10

Association between glycemic abnormalities and acute cardiovascular events

In our study, the prevalence of glycemic dysregulations in non-diabetic patients was 37% based on admission blood glucose. Our results were similar to those of the Euro Heart Survey on diabetes and the heart in Europe, where the prevalence of glycemic dysregulations in patients with acute coronary artery disease was 37% out of a total of 4196 patients [9].

Several mechanisms are intertwined in diabetic heart disease, including muscle insulin resistance, muscle hypoperfusion, neurohumoral activation and insulin secretory disorders. There is a two-way relationship between type 2 diabetes and heart failure. On the one hand, it is well known that diabetes mellitus predisposes to the onset of heart failure, through various more or less interrelated mechanisms. On the other hand, it has recently emerged that heart failure is a hemodynamic condition that increases the risk of developing type 2 diabetes.

A sub-analysis of the Bezafibrate Infarction Study revealed a correlation between heart failure, insulin resistance and the incidence of new cases of diabetes. [10] Moreover, our study showed that 14% were unrecognized diabetics and 29% prediabetics. This is the thrust of the ESC and EASD recommendations published in 2007, which advocated the systematic performance of an OGTT in patients presenting with an acute cardiovascular event. The aim was to manage vascular disease, and above all metabolic disease, at an early stage, in order to slow its progression [11].

Cardiovascular prognosis of patients with impaired glycemic regulation

In our study, we found no significant correlation between NT-proBNP levels, left ventricular hypertrophy, LVEF and glycoregulatory disorders. In contrast to our findings, a study conducted in China [12] demonstrated that glycoregulation disorders were a risk factor for poor prognosis. Indeed, in-hospital mortality was increased the more glycemic regulation was abnormal. They found that NT-proBNP was significantly elevated.

In a 2000 meta-analysis, increased in-hospital mortality was demonstrated in acute myocardial infarction patients with hyperglycemia on admission, both those with and those without known diabetes [13]. High blood glucose levels on admission are also associated with a poorer long-term prognosis, and appear to be an independent risk factor for new heart attacks, rehospitalization for failure and major cardiovascular events [14].

Study limitations:

It is important to highligh a limitation of our study wich lies in the inability to perform OGTT tests in patients, which limited our ability to detect all glycemic dysregulations. Some patients could have normal HbA1C and fasting glucose (FPG) levels, but abnormal OGTT, leading to a diagnosis of diabetes. Therefore, our study may potentially include undiagnosed diabetic patients.

Conclusion

Acute cardiovascular events represent a real public health issue and a complex pathology requiring a multidisciplinary approach. Our study focuses on an aspect little explored in practice, namely the prevalence of glycemic dysregulations during the acute phase of a cardiovascular event.

The early introduction of screening for abnormalities in glycemic regulation offers several potential advantages. On the one hand, by identifying individuals at risk, early and appropriate therapeutic intervention could improve prognosis as a complement to conventional treatments. On the other hand, by diagnosing these dysregulations early, appropriate therapeutic management could potentially prevent the progression of pre-diabetes to established diabetes.

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