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ORIGINAL PAPER

The Impact of Acute Myocardial Infarction on Left Ventricular Systolic Function

Dardan Koçinaj[1], Aurora Bakalli[1], Masar Gashi[1], Luljeta Begolli[1], Merita Berisha[2], Allma Koçinaj[1], Blerim Berisha[1], Xhevdet Krasniqi[1].
University Clinical Centre of Kosovo, Prishtina, Republic of Kosovo[1]
National Institute of Public Health of Kosovo, Prishtina, Republic of Kosovo[2]

Background. During acute myocardial infarction left ventricular systolic function is an important prognostic factor whose worsening is still frequent despite the therapeutic approach. We aimed to estimate the incidence of left ventricular systolic dysfunction among patients experiencing acute myocardial infarction. **Methods.** The study involved 154 consecutive patients admitted at Coronary Care Unit. The study design was based upon the collection of patient histories, clinical examination and other complementary tests. **Results.** In overall study population, predominantly with male gender, the incidence of left ventricle systolic dysfunction was 42.3%, which correlated with myocardial damage, electrocardiography changes, myocardial enzymes, and myocardial wall motion. **Conclusions.** Transthoracic Echocardiography represents a valuable tool and left ventricular ejection fraction should be evaluated in all patients experiencing acute myocardial infarction since the incidence of left ventricular dysfunction in patients with Acute Myocardial Infarction remains relatively high. **Key words:** acute myocardial infarction, left ventricle function, echocardiography.

Corresponding author: Koçinaj Dardan, MD. University Clinical Centre of Kosovo Rrethi i Spitalit p.n. 10000 Prishtina, Republic of Kosovo. Tel. +37744312144. Fax. +38138556562. e-mail: dall_k@yahoo.com

1. INTRODUCTION

The assessment of left ventricular function following acute myocardial infarction (AMI) has been shown in many studies to give important prognostic information as well as helping to guide therapeutic intervention. Although Wall Motion Score Index (WMSI) assessed by echocardiography is a relatively easily obtained marker of global left ventricular (LV) dysfunction, a greater degree of wall motion abnormality must take place before a lower ejection fraction (EF) occurs. Several studies have shown that WMSI correlates well with LV EF and some have directly compared it in the assessment of prognosis after myocardial infarction (1).

Patients with AMI who have diabetes have an increased risk of death. It has also been shown that undiagnosed glycemic abnormalities are common in patients with an acute myocardial infarction, which are detectable early in the post infarction period. These disorders in the early phase of an acute myocardial infarction could be used as early markers of high-risk patients (2). Nevertheless, the issue of whether glucose concentrations below the diabetic threshold may be predictive of increased cardiovascular risk has not yet been fully elucidated. Some findings suggest the increased mortality rate among nondiabetic coronary patients with impaired fasting glucose (3) known as a direct and independent risk factor. The mechanisms are attributed in the production of free radicals, which favours the development of an endothelial dysfunction (4, 5). Also, on the other hand, the risk of acute coronary events is significantly increased and is similar to that of patients without diabetes who have already had a myocardial infarction. Nowadays diabetics are accounting for a greater proportion of the global population, increasing the number of hospital admissions, being at heightened risk of heart failure, cardiogenic shock and death (6).

On the other hand, among other laboratory parameters, although there is an evidence of increase in the number of white blood cells, still few data exist about the relationship of circulating granulocyte-macrophage colony stimulating factor and some soluble adhesion molecules to the severity of AMI and the pathophysiological events of post-infarction LV dysfunction (7).

Some other techniques, as quantitative analysis of color kinesis images, provide easy information of endocardial excursion, enabling fast, objective and more accurate evaluation of LV regional wall motion (8). The main aim of our study was to estimate the incidence of LV systolic dysfunction among patients experiencing acute myocardial infarction. We also had a purpose to determine the most exposed gender, age, previous related diseases, and early in-hospital mortality. Finally we aimed to evaluate the relationship between extension of myocardial damage at ECG, myocardial enzymes, WBC and myocardial regional contractility involvement.

2. MATERIALS AND METHODS

2.1. Population

This cross sectional prospective study involved 154 consecutive patients aged <75 years admitted at Coronary Care Unit of our Institution for Acute Coronary Syndromes and treated by noninvasive management protocol.

2.2. Study design

The study design was based upon the collection of patient histories, clinical examination and laboratory data, the ECG, and the transthoracic echocardiography.

2.3. Diagnostic criteria

Acute myocardial infarction (AMI) was defined by elevated cardiac markers associated with more than one of the following characteristics: symptoms of myocardial ischaemia, development of ST-T abnormalities considered of ischaemic origin, and/or development of new Q waves. Hypertension and/or Diabetes mellitus were reported either if a patient had a history of the disease or documented an ongoing treatment. Previous Myocardial Infarction was encountered by previous history, documentation or present ECG.

2.4. Transthoracic echocardiography

All patients underwent conventional transthoracic echocardiography using commercially available equipment (Phillips iE 33). Transthoracic echocardiographic (TTE) examinations and measurements were performed with the subject in the left lateral decubitus position, according to the recommendations of the American Society of Echocardiography (9). Left ventricular end-diastolic/end-sistolic diameters, wall (septal and posterior) thickness have been measured from parasternal M-mode recordings according to standard criteria.

Left ventricular ejection fraction (EF%) was determined from apical views with a modified Simpson's rule. Left ventricle systolic function was considered impaired if ejection fraction <45 %. Assessement of wall motion abnormalities (WMA) was made according to the recommendation of AHA Writing Group on Myocardial Segmentation and Registration for Cardiac Imaging (2002). WMSI was derived by grading the wall motion of individual myocardial segments (motion and systolic thickening) and dividing the total score by the number of analyzable 17-segments (9, 10). The function of each segment was confirmed in multiple views. Segment scores were as follows: normal or hyperkinesis =1, hypokinesis = 2, akinesis (negligible thickening) = 3, dyskinesis (paradoxical systolic motion) = 4 and aneurysmal (diastolic deformation) = 5.

Modalities	N	%
M	99	64.3
Average age±SD	61.4 ±11.8	
Hypertension	48	31.2
Diabetes mellitus	31	20.1
Previous MI	14	9.1
AMI non anterior	67	43.5
Early In-Hospital Mortality	9	5.8

Table 1. Basic Characteristics of the Study Population

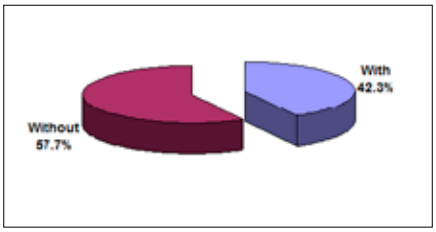

Figure 1. Left ventricular systolic dysfunction among the analyzed patients

2.5. Statistical analyzes

Collected data were analyzed, presented by tables and figures, statistical parameters (mean, SD, etc.) were calculated and tested. These data are discussed with relevant data from the references. Correlation between variables was calculated using Person correlation test. P value < 0.05 was considered of statistical significance.

3. RESULTS

3.1. Basic demographic data of the study population

Total number of the examined population was 154 with a mean age 61.4 (±11.8) years. Male gender was predominant in our overall study population, accounting 64.3%. All the patients were diagnosed as acute myocardial infarction. Around one third of them (31,2%) had arterial hypertension, 31 (20.1%) had diabetes mellitus and 9.1% had previously suffered a myocardial infarction.

Based on electrocardiography, the acute episode of myocardial infarction appeared to happen mostly in the anterior left myocardial wall, while the non anterior AMI was found on 43.5% of this population. The early In-hospital mortality occurred on 9 (5.8%) out of the patients included in the study, (Table 1) two of them where diabetics with LV systolic dysfunction.

3.2. Impaired left ventricle systolic function

In overall study population, predominantly with male gender, the incidence of left ventricle systolic dysfunction was 42.3%. (Figure 1).

The average value of ejection fraction of all analyzed patients was 49.4±9.5%. In patients with low ejection fraction, nine of them were diabetics, whereas three of them have ended up fatally.

3.3. Correlation of several parameters of our study population

There was a significant high correlation r=0.87, p<0.001 between left ventricle ejection fraction and WMSI, and a negative medium correlation r=-0.4, p<0.001 between left ventricle ejection

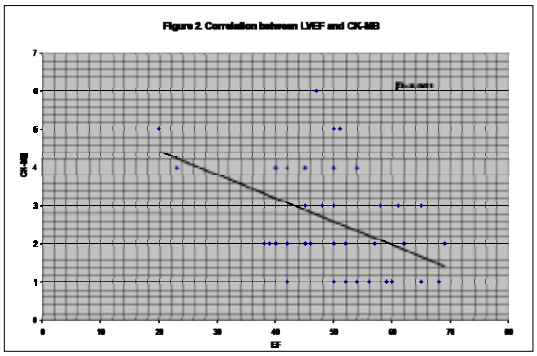

Figure 2. Correlation between LYEF and CK-MB

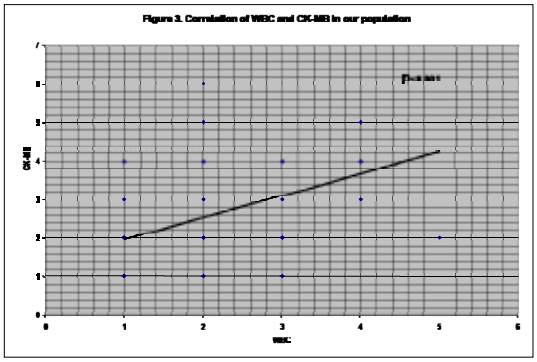

Figure 3. Correlation between WBC and CK-MB in our population

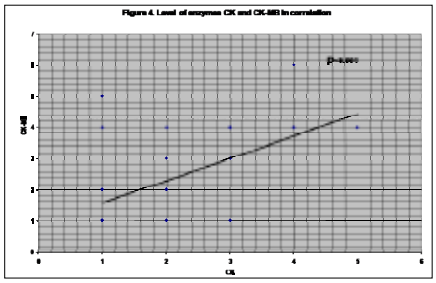

Figure 4. Levels of enzymes CK and CK-MB in correlation

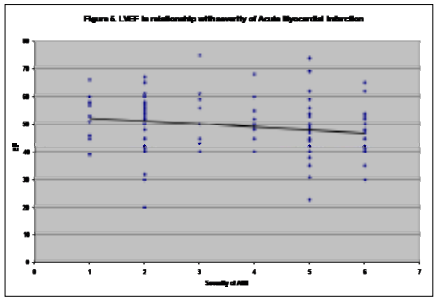

Figure 5. LYEF in relationship with severity of Acute Myocardial infarction

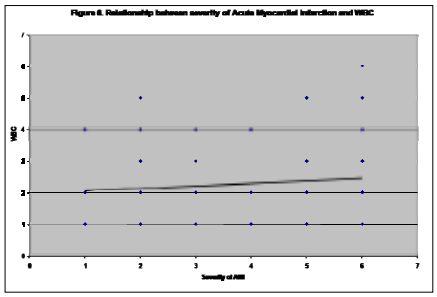

Figure 6. Infarction and WBCFigure 6. Relationship between severity of Acute Myocardial and WBC

fraction and CK-MB. (Figure 2). Opposite same correlation r=0.4, p<0.001 has been found between WBC and CK-MB (Figure 3), while a significant correlation, r=0.7, p<0.001 of CK and its isoenzyme CK-MB. (Figure 4). A negative low correlation was found between LVEF and severity of AMI. The latter had also low correlation with WBC. (Figure 5 and 6).

4. DISCUSSION

The risk of heart failure is particularly high in diabetic patients with MI and was the most common cause of death, also reported in the DIGAMI (Diabetes mellitus Insulin-Glucose infusion in Acute Myocardial Infarction) study (11, 12). One fifth of our population had diabetes but there was no difference in term of impaired left ventricular function related to the rest of study group, but still there is evidence of relatively aged population even with history of previous MI which also increases the risk of post AMI complications comparable to diabetes. On the other side, Parissis et al. reported a significant elevation, with the highest values, of plasma GM-CSF and soluble adhesion molecules, in patients with AMI complicated by heart failure manifestations. Though, they may contribute to the pathophysiology of the disease and post-infarction cardiac dysfunction (7). Our data relied on a single value of WBC, which in general showed a low correlation with severity of AMI based on ECG changes, but still a good correlation to CK-MB isoenzyme. WMSI as an easily measurable marker of LV function closely correlates with EF post AMI. A closer correlation is reported for anterior infarctions before discharge. WMSI of 0.6, 0.8, and 1.1 correspond best to EF 45%, 40%, and 35%, respectively based on RNV (radionuclide ventriculography) (1). Our data suggest a significant high correlation of those two parameters.

5. CONCLUSIONS

The incidence of left ventricle dysfunction in patients with Acute Myocardial Infarction remains relatively high. Heart failure commonly complicates acute myocardial infarction in patients with diabetes. The level of myocardial injury correlates with development of left ventricular failure and regional contractility involvement. Transthoracic Echocardiography represents a valuable tool and left ventricular ejection fraction should be carefully evaluated in all patients experiencing acute myocardial infarction. At present prevention of myocardial infarction remains the main management goal for protecting people with diabetes from the risk of heart failure.

STUDY LIMITATION

Limitation of the present study is the relatively small study group and no repetition of Echocardiography study. ABREVIATIONS: AMI- Acute Myocardial Infarction, WMSI- Wall Motion Score Index, LV- Left Ventricle, EF- Ejection Fraction, CCU- Coronary Care Unit, ECG- Electrocardiography, WBC- White Blood Cells, TTE- Transthoracic Echocardiography, WMA- Wall Motion Abnormalities, CK-MB- Creatine Kinaze- MB isoenzyme, CK- Creatine Kinaze, DIGAMI- Diabetes mellitus Insulin-Glucose infusion in Acute Myocardial Infarction, GM-CSF- Granulocyte-Macrophage Colony Stimulating Factor, RNV- Radionuclide Ventriculography

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