THE INFLUENCE OF TROPONIN I IN IMPROVING THE ACCURACY IN THE DIAGNOSIS OF MYOCARDIAL INFARCTION COMPLICATIONS IN A GEOGRAPHICALLY DEFINED STEMI POPULATION

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Abstract: *The third universal definition of AMI (acute myocardial infarction) in 2012 emphasizes the role of biomarkers in this situation. The objective of our study was to assess the significance of TnI in improving diagnostic accuracy and prognosis in a population - IMASST (ST segment elevation myocardial infarction) in Arges County. We retrospectively studied a cohort of 1,008 patients with STEMI admitted to the USTACC clinic, between January 1 2009-31 May 2013 with the following locations: anteriorly 38.79 %, inferiorly 30.06 %, laterally 12.70 %, posteriorly 3.77 % and associated 14.68 %. We stratified the cohort according to the following criteria: clinical (pain or equivalent), ECG (area under the ST in the relevant branch), biomarkers (TnI - troponin I), echocardiography and we followed the correlation of these parameters both in the diagnosis of STEMI, and regarding the following six events: thrombolysis, PCI (percutaneous coronary intervention), CABG (aortocoronary bypass), cardiogenic shock, acute pulmonary edema (APE), mortality. TnI relevant values group (80.26 %) correlates much better with all six events compared with group TnI <0.05 pg / mL. In addition, the subgroup with TnI more than 10 ng / mL developed acute pulmonary edema and / or cardiogenic shock in 90.67 % with PCI and CABG growth and high mortality. In this STEMI population, TnI improves diagnostic accuracy and the management of complications. "Troponin blindness" rate of 19.74 % can be explained either by the quality of the biomarker, either by the late presentation of the majority of the patients.*

Cuvinte cheie: *troponina I, infarct miocardic*

Rezumat: *A treia definiţie universală a IMA (infarct miocardic acut) 2012 subliniază rolul biomarkerilor în această situaţie. Obiectivul studiului nostru a fost evaluarea importanţei TnI în ameliorarea acurateţii diagnostice şi prognostice la o populaţie IMASST (IMA cu supradenivelare de segment ST) din judeţul Argeş. Am studiat retrospectiv o cohortă de 1008 pacienţi cu STEMI internaţi în clinica USTACC în perioada 1 Ian. 2009 – 31 Dec. 2013, cu următoarele localizări: anterior 38,79%, inferior 30,06%, lateral 12,70%, posterior 3,77%, asociate 14,68%. Am stratificat cohorta după următoarele criterii: clinic (durere sau echivalent), ECG (aria de sub curba ST din cea mai relevantă derivaţie), biomarkeri (TnI -troponina I), ecocardiografic şi am urmărit corelaţia acestor parametri, atât în cadrul diagnosticului STEMI, cât şi cu următoarele şase evenimente: tromboliză, PCI (intervenţie coronariană percutanată), BAC (by pass aortocoronarian), şoc cardiogenic, edem pulmonar acut (EPA), mortalitate. Grupul cu valori TnI relevante (80,26%) se corelează mult mai bine cu toate cele şase evenimente, comparativ cu grupul cu TnI < 0,05 pg/mL. În plus, subgrupul cu TnI peste 10 ng/mL a dezvoltat edem pulmonar acut şi/sau şoc cardiogenic în 90,67%, cu creşterea necesităţii PCI şi BAC şi mortalitate înaltă. În această populaţie STEMI, TnI ameliorează acurateţea diagnostică şi managementul complicaţiilor. Rata de "troponin blindness" de 19,74% poate fi explicată fie prin calitatea biomarkerului, fie prin prezentarea tardivă a unei majorităţi a pacienţilor.*

INTRODUCTION

The first universal definition of acute myocardial infarction (AMI) in 2000, so called ESC/ACC criteria, was in response to the emerging role of biomarkers as a new and accurate reflection of pathology. Until then, the World Health Organization (WHO) definition of AMI had been applied, but that definition failed to recognize that any myocardial necrosis in the setting of myocardial ischaemia should be labelled as AMI.

The second edition of the universal definition of AMI jointly issued by the European Society of Cardiology (ESC), the American College of Cardiology Foundation (ACCF), American Heart Association (AHA) and the World Heart Federation (WHF), also recognized that the management of patients (pts) with AMI had significantly improved in recent years, resulting in less myocardial injury and necrosis despite a similar clinical presentation. It was necessary to distinguish between the various conditions which may cause AMI, such as "spontaneous" or "procedure related". In addition, this definition incorporated investigation and diagnosis following cardiac surgery or PCI.

The third universal definition of AMI 2012 underlines the role of biomarkers in this setting. The overall pathological definition of AMI remained as myocardial cell death as a result

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of prolonged ischaemia, with the definition applicable in any of five types:

- Type 1 – spontaneous AMI
- Type 2 – AMI secondary to ischaemic imbalance
- Type 3 – AMI resulting in death when biomarkers are unavailable
- Type 4 – AMI related to PCI (with 4b related to stent thrombosis) and
- Type 5 – related to ACBP (1)

PURPOSE

Our centre is non-interventional and the nearest tertiary centre is located at 110 km. Nowadays, we are preparing to establish a catheterization laboratory. Since 2007, in our institution, biomarkers are available in AMI and in heart failure, so doctors are experienced in using and interpreting this diagnostic tool.

The aim of our study was to assess the TnI value in improving the diagnostic and prognostic accuracy in Argeș county ST elevation myocardial infarction (STEMI) population.

METHODS

The cardiac biomarker facility in our clinic is a Pathfast device. The preferred biochemical marker of myocardial necrosis, overall and for each specific category of AMI is TnI, which has high myocardial tissue specificity as well as high clinical sensitivity. Detection of a rise and/or fall of the measurements is essential to the diagnosis of AMI. An increased TnI concentration is defined as a value exceeding the 99th percentile of a normal reference population. This discriminatory 99th percentile is designated as the decision level for the diagnosis of AMI and must be determined for each specific assay with appropriate quality control in each laboratory.(2)

We studied retrospectively a cohort of 1008 pts with STEMI admitted in our coronary care unit (CCU) (3) clinic from 1st Jan. 2009 to 31st Dec. 2013, with the following locations: anterior 38,79%, inferior 30,06%, lateral 12,70%, posterior 3,77%, combos 14,68%. We have stratified the cohort using the following criteria: clinical (pain or equivalent), ECG - electrocardiogram (area under the ST curve in the most relevant derivation), biomarkers (TnI), echocardiography, and we followed the correlation of these parameters within the STEMI diagnosis and with the following six events: thrombolysis, PCI, ACBP, cardiogenic shock, acute pulmonary edema, mortality.

The ECG is an integral part of the diagnostic work-up of patients with suspected AMI and is routinely promptly acquired and interpreted after clinical presentation. Echocardiography is performed by experienced specialists with the device Agilent 4500. The strength of echocardiography is the assessment of cardiac structure and function, in particular myocardial thickness, thickening and motion. We steadily register in our pts segmental kinetics abnormalities like hypokinesia, akinesia, or dyskinesia.

RESULTS

The group with relevant TnI values (80,26%) correlated much better with all six events than the group with TnI < 0,05 ng/mL. In addition, the subgroup with TnI over 10 ng/mL developed acute pulmonary oedema and/or cardiogenic shock in 90,67%, with subsequent higher necessity of PCI and ACBP, and higher mortality.(4)

In the following table, the six events are distributed on TnI tertiles.

Table no. 1. Distribution of events on TnI tertiles

TnI value	0,22 – 0,99 ng/mL	1,00 – 9,99 ng/dL	> 10,00 ng/mL	Total
Number of pts	478	259	72	809
Thrombolysis	42	99	63	207
Acute PE	61	60	23	144
Cardiogenic shock (CS)	55	59	21	135
APE + CS	4	5	21	30
PCI	51	83	49	183
ACBP	2	9	7	18
Death	26 (6,07%)	29 (10,04%)	14 (16,28%)	69 (9,81%)

There are opportunities of PCI and CABG within the RO_STEMI programme, and limits concerning the non-interventional profile of our centre. The majority of PCI pts are facilitated and not primary, in order to reduce the transportation risks. There are differences in mortality between tertiles, underlying the importance of biomarkers. That means the value of TnI is closely related with area of myocardial necrosis and, subsequently, with the rate of complications, fatal and non-fatal acute pulmonary oedema and/or cardiogenic shock.

DISCUSSIONS AND CONCLUSIONS

All these pts are admitted with spontaneous AMI, Type 1. This is an event related to atherosclerotic plaque rupture, ulceration, fissuring, erosion, or dissection with resulting intraluminal thrombus in one or more of the coronary arteries, leading to decreased myocardial blood flow or distal platelet emboli with ensuing myocyte necrosis.

In this STEMI population, TnI improves the accuracy of diagnosis and management of complications. The rate of troponin blindness of 19,74%could be explained either by the quality of the biomarker, or by the late presentation in a majority of patients.

Our results are a bit different from the literature, reflecting the particular reactivity of this population, and the infrastructure. Since 2013, we perform multimarker approach in our ICCU clinic and as the experience will grow up, it will be communicated.

This paper could become historical when interventional cardiology will be available in our centre.

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