High sensitivity troponin in infarcted patients with history of myocardial infarction

High sensitivity troponin in myocardial infarction

ABSTRACT

Design of the study: historical cohort

Objectives: this study aimed to verify which risk factors contribute to increase hs-cTnI in patients with Myocardial Infarcion with ST segment elevation, to analyze which prognostic impacts it may have and to evaluate troponin levels in patients that had previous acute myocardial infarction and assess how this compared to patients without previous history of an acute event.

Methodology: It was assessed medical records of patients admitted in the Coronary Unit of the Hospital de Clínicas (HC-UFPR) in Curitiba, South of Brazil, diagnosed with ST segment elevation Myocardial Infarction and whose serum levels of high sensitivity troponin I (hs-cTnI) were collected at admission moment. The select data were: gender, age, high blood pressure, smoking, diabetes, previous myocardial infarction, dyslipidemia and serum levels of high sensitivity troponin I. For prognostic proposes, it was analysed intra-hospital death and ventricular function, based on left ventricular ejection fraction.

Findings: Patients admitted with previous myocardial infarction had lower levels of hs-TnI. Gender, age, presence of high blood pressure, tabagism, diabetes and dyslipidemia didn't reveal correlation with troponin values, allowing the inference that high sensitivity troponin values at first presentation of these patients have no direct relation to these variables. Regarding prognosis, levels of high sensitivity troponin could not be associated to mortality or ventricular malfunction

Conclusions: At admission, high-sensitivity troponin I levels were lower in patients with prior myocardial infarction.

Relevance: This work correlates the values of the high-sensitivity troponin of patients with ST segment Elevation Myocardial Infarction to cardiovascular risks factors and to the prognosis of these patients. This approach is not found in current medical literature, whose works mainly relates to acute events.

Keywords: diagnosis; myocardial infarction; prognosis; troponin.

INTRODUCTION

The use of biomarkers for diagnosis of acute myocardial infarction (AMI) is a clinical practice that has been used since the last century. Laboratory research for acute myocardial infarction had measures of creatine phosphokinase and it's MB fraction (CK-MB) as gold standards, while conventional cardiac troponin test was in the background. From 2003, more sensitive cardiac troponin (cTn) level tests were available, and in 2007 the creation of a "high-sensitivity" test occurred. In this context, Between 1995 and 2007 the limit of detection fell from 0.5 ng/mL for some cTn assays to 0.006 ng/mL; nowadays, tests have further reduced this value and levels as low as 6 ng/L can be scanned.[1]

The evolution of cardiac biomarkers implies a new reality to medical practice, which includes early diagnosis of Acute Coronary Syndrome, allowing acknowledgment of patient's prognosis in severe cases and the follow-up of therapeutic effects generated by treatment.[2]

Several studies have shown that conventional troponin levels are related to prognosis of patients with acute myocardial infarction[3-5]. Bertin Lindahl et al.[5] concluded that elevations of conventional T troponin were associated with a higher probability of coronary stenosis, thrombogenesis, and increased risk of reinfarction and death.[5]

When compared to the conventional troponin test, with high-sensitivity troponin test small values os troponin can be identified in the blood, meaning that lower variations in levels of this biomarker can be detected and, therefore, time from one

measure to the next can be shortened, making diagnosis faster and therapy more efficient.[6]

On the other hand, more sensitive tests come with a cost since it's high sensitivity predisposes the evaluator to be more frequently facing "false positive" results - aortic dissection, cardioverter, pulmonary embolism, renal failure and sepsis are examples of clinical situations that generate troponin elevations even in the absence of myocardial necrosis. It should, then, have a better decision impact when applied in a population with suggestive clinic, avoiding low pretest probability.[7] Despite what is known about conventional troponins, there is no scientific evidence in literature that variation of High-sensitivity troponin serum levels have a prognostic relationship with infarcted patients.

Given the need for a better understanding of this exam (High-sensitivity troponin test) and the benefits that it's interpretation can bring to proper care of patients suffering from an acute coronary event, this study aimed to verify which risk factors contribute to increase hs-cTnI in patients with Myocardial Infarcion with ST segment elevation, to analyze which prognostic impacts it may have and to evaluate troponin levels in patients that had previous acute myocardial infarction and assess how this compared to patients without previous history of an acute event.

METHODS

This study is a historical cohort in which medical records of patients of the Hospital de Clínicas (HC/UFPR) were reviewed. They were admitted to the Coronary Unit in the period between January 1, 2014 and December 31, 2014, with diagnosis of acute myocardial infarction with ST-segment elevation and had their serum levels of hs-cTnI measured on admission. Patients under 18 years old, patients who did not

present electrocardiographic findings of AMI with ST-segment elevation, or whose hs-cTnI serum level was not collected at admission were excluded from this study.

Data on gender, age, High Blood Pressure (HBP), smoking, diabetes mellitus (DM), previous infarction, dyslipidemia, hs-cTnI, intra hospital death and left ventricular ejection fraction (EF) were collected. Among these data, intra hospital death and ventricular dysfunction (EF<45%) were used for prognostic analysis.

All procedures were submitted and approved for the Research Ethics Committee (CEP) of the Hospital de Clínicas da Universidade Federal do Paraná, where the study was conducted.

RESULTS

We selected 77 patients who met the inclusion criteria. 30 were female (38.9%) and 47 male (61.0%), with a mean age of 61.2 years, avarage of 61,2 years and median value of 61 years. Prevalence of risk factors for acute coronary events in this population is in table 1 and their relationship with high-sensitive troponin values obtained at hospital admission in table 2. As for variables of prognostic value, intra hospital death occurred in 11.1% of the cases and ejection fraction was lower than 45% in 28.3% of the patients.

Table 1: Prevalence of risk factors for Acute Coronary Syndrome (ACS) in the studied population

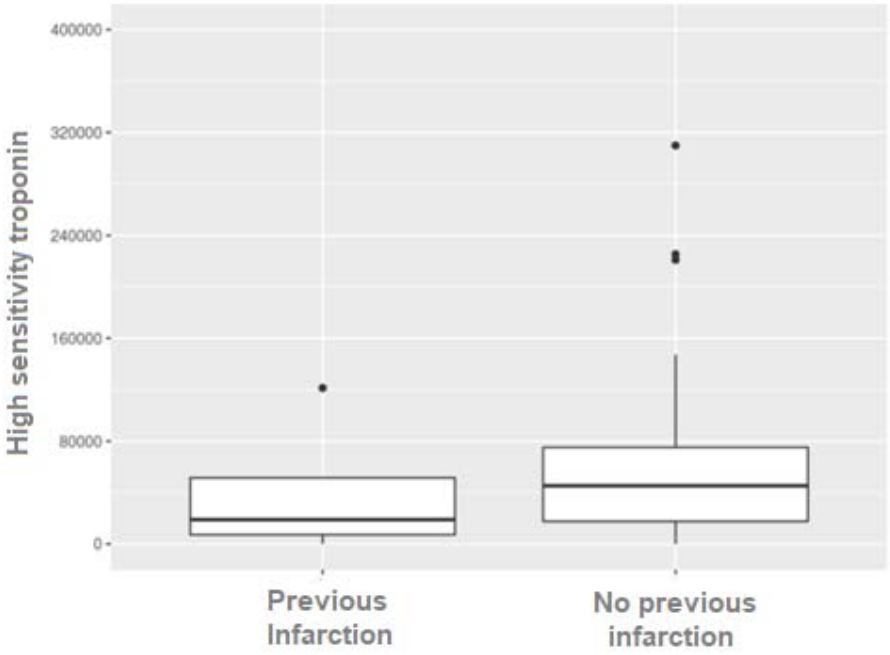
Risk factor	Prevalence
Dyslipidemia	81,5%
High Blood Pressure	66,1%
Smoking	56,9%
Diabetes	36%
Previous infarction	8,4%

Table 2: Relationship of hs-cTnI values with independent variables studied, according to Mann-Whitney test, Hs-cTnI (pg/L) values correspond to the medians obtained

Variables	Hs-cTnI with Risk Factor	Hs-cTnI without Risk factor	p
Previous infarction	4899	50.000	0,0211
Diabetes	50.000	35.201	0,4171
HBP	50.000	46.214	0,5154
Dyslipidemia	45.289	53.239	0,9306
Intra Hospital Death	30.501	39.831	0,9786
EV<45%	28.751	48.111	0,5358

Statistical analysis was based on models for independent samples. There was statistical significance in the relation of hs-cTnI with previous myocardial infarction (graph 1). For the other analyzed variables, no statistical significance was obtained in their comparisons with hs-cTnI values.

Graph 1: Comparison of hs-cTnI (pg/L) with episode of previous infarction.



DISCUSSION

Patients with history of previous heart infarction had lower serum hs-cTnI. This might reflect the importance of cardiac collateral circulation in a second event, which contributes to a lower muscle loss.[9-10] Myocardial viability after a ischemic event is related to collateral blood flow within the infarcted area and in patients with chronic coronary artery disease, there is development of a collateral circulation network to supply the cardiac tissue demand.[11] Therefore, in an acute ischemic event, myocyte loss due to arteriolar obstruction is lower in patients who have a better established collateral circulation. This fact may justify the lower levels of hs-cTnI in patients who have had an infarction, since the existence of this previous event suggests that coronary heart disease is present for a longer period of time, there is a preconditioning adaptation of the heart and a collateral circulation network is better established.

It is important to emphasize that lower muscle loss cannot be translated into a better prognosis, since patients already infarcted tend to have more comorbidities than patients who are suffering the acute coronary event for the first time. The HORIZONS-AMI[12] study indicates that reinfarction is a strong predictor of worse prognosis, and it has been found that these patients, besides having more comorbidities, are older, less likely to receive the treatment recommended by the guidelines and most often suffer cardiogenic shock. In our study, prognostic analysis - which included intra hospital death and ventricular dysfunction - was unable to determine a relationship between hs-cTnI serum levels and prognosis.

Current studies have approached hs-cTIn levels and its relation to acute events, especially acute myocardial infarction and possible differential diagnoses. In addition, it was found that periodic measurements of hs-cTnI in the investigation of acute infarction provides a high negative predictive value - 99.6% according to Gimenes et al[13] -, however, the international literature lacks studies that assess the interference of risk factors, usually present in patients who develop acute coronary syndrome, in the alteration of hs-cTnI.

Our study aimed to supply this literary need and, through its results, generated new hypotheses to be evaluated. Through its findings it is possible to say that new questions about acute myocardial infaction in patients who are suffering such event for a second time should be made. No study has been made to compare if and how the high-sensitivity troponin curve of these patients differ from those whose hearts are suffering the acute event for the first time, and, as lower levels of hs-cTnI in a second event was observed in our study a question raises: should there be any particularity when interpreting the troponin values of patients with history of an acute event and that are now undergoing a suggestive clinic of myocardial infarction? There is a need to carry out new studies that contemplates a larger number of pa-

tients and, in addition to assessing hs-cTnI on admission moment, also analyze the variation of this cardiac biomarker over time and the relation thereof with cardiovascular risk factors and with the prognosis of the patients.

CONCLUSION

High-sensitivity troponin I levels were lower in patients with previous myocardial infarction. No correlation was found with the other risk factors evaluated. Finally, high-sensitive troponin I serum levels could not be correlated with prognosis of patients who were having an acute coronary ischemic event.

Consent Disclaimer:

As per international standard or university standard, patient's consent has been collected and preserved by the authors.

REFERENCES

1. Mahajan VS, Jarolim P. How to interpret elevated cardiac troponin levels. Circulation. 2011;124(21):2350–4.
2. Sherwood MW, Kristin Newby L. High-sensitivity troponin assays: evidence, indications, and reasonable use. J Am Heart Assoc. 2014;3(1):1–11.
3. Hamm C, Ravkilde J, Gerhardt W, Jorgensen P, Peheim E, Ljungdahi L et al. The Prognostic Value of Serum Troponin T in Unstable Angina. New England Journal of Medicine. 1992;327(24):1760-1761.
4. Antman E, Tanasijevic M, Thompson B, Schactman M, McCabe C, Cannon C et al. Cardiac-Specific Troponin I Levels to Predict the Risk of Mortality in Patients with Acute Coronary Syndromes. New England Journal of Medicine. 1996;335(18):1342-1349.
5. Lindahl B, Diderholm E, Lagerqvist B, Venge P, Wallentin L. Mechanisms behind the prognostic value of troponin T in unstable coronary artery disease: a FRISC II substudy. Journal of the American College of Cardiology. 2001;38(4):979-986.
6. Twerenbold R, Boeddinghaus J, Nestelberger T, Wildi K, Rubini Gimenez M, Badertscher P et al. Clinical Use of High-Sensitivity Cardiac Troponin in Patients With Suspected Myocardial Infarction. Journal of the American College of Cardiology. 2017;70(8):996-1012

7. Sara J, Holmes D, Jaffe A. Fundamental Concepts of Effective Troponin Use: Important Principles for Internists. The American Journal of Medicine. 2015;128(2):111-119.

8. Wallace T. Prevalence and Determinants of Troponin T Elevation in the General Population. Circulation. 2006;113(16):1958-1965.

9. Steg P, Kerner A, Mancini G, Reynolds H, Carvalho A, Fridrich V et al. Impact of Collateral Flow to the Occluded Infarct-Related Artery on Clinical Outcomes in Patients With Recent Myocardial Infarction: A Report From the Randomized Occluded Artery Trial. Circulation. 2010;121(25):2724-2730.

10. Kim E, Choi J, Song Y, Hahn J, Chang S, Park S et al. A protective role of early collateral blood flow in patients with ST-segment elevation myocardial infarction. American Heart Journal. 2016;171(1):56-63.

11. Sabia PJ, Powers ER, Ragosta M, Sarembock IJ, Burwell LR, Kaul S. An association between collateral blood flow and myocardial viability in patients with recent myocardial infarction. N Engl J Med 1992;327:1825-1831

12. Stone S, Serrao G, Mehran R, Tomey M, Witzenbichler B, Guagliumi G et al. Incidence, Predictors, and Implications of Reinfarction After Primary Percutaneous Coronary Intervention in ST-Segment-Elevation Myocardial Infarction: The Harmonizing Outcomes With Revascularization and Stents in Acute Myocardial Infarction Trial. Circulation: Cardiovascular Interventions. 2014;7(4):543-551.

13. Teggert A, Twerenbold R. One-hour rule-in and rule-out of acute myocardial infarction using high-sensitivity cardiac troponin I. Annals of Clinical Biochemistry. 2015;52(6):720-720.