



Cardiac Troponin T as a Sensitive Marker of Myocardial Infarction in Hypertensive Patients

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RECEIVED: 4/8/2013

ACCEPTED: 9/3/2014

ABSTRACT

This study aimed to detect cardiac troponin T in Sudanese hypertensive patients along with the lipid profile. Cardiovascular disease is one of the common diseases prevalent in the recent period in the world, and deviate the etiology is a preventive benefit for people proper diagnostic and therapeutic for patients and contributes to accelerate healing and reduce the rate of complications. This study was conducted to determine the impact of hypertension on the heart. Hypertension is known as the most important arteries diseases. In this study, myocardial infarction was determined as one of the most important heart disease resulting from the impact of hypertension. Blood samples which were collected from one hundred patients, troponin T was measured by Elcysys 2010, troponin T is a protein released from damage heart muscles, lipid profile were also measured in blood samples to see their relationship with troponin T levels. Diagnoses with myocardial infarction was done by electrocardiogram (ECG). High significant levels of troponin T and high density lipoprotein were found in patient samples, also a significant relationships between troponin T levels and total cholesterol, troponin T levels and low density lipoproteins were found. This study concluded the necessity of dealing with hypertension properly to its direct impact on the heart muscle.

المستخلص

كان الهدف من هذه الدراسة هو التحقيق في الفائدة السريرية لتروبونين تي ودهون الدم كعلامات لتشخيص حالة القلب بين مرضى ارتفاع ضغط الدم الذين يعانون من ألم في الصدر. أمراض القلب والشرابين تعتبر من الأمراض الشائعة والمنتشرة في الفترة الأخيرة على مستوى العالم , وتحديد المسببات يعتبر ذو فائدة وقائية للأشخاص السليمين وتشخيصية وعلاجية للمرضى ويساهم في تعجيل الشفاء ويقلل من نسبة المضاعفات . أجريت هذه الدراسة لمعرفة تأثير مرض ضغط الدم على القلب , ومرض ضغط الدم من أهم أمراض الشرابين المعروفة . في هذه الدراسة تم تحديد مرض احتشاء عضلة القلب كواحد من أهم أمراض القلب الناتجة من تأثير مرض ارتفاع ضغط الدم. جمعت عينات دم من 100 مريض بارتفاع ضغط الدم كمجموعة دراسة (59 من الرجال و 41 من النساء, تتراوح أعمارهم من 26 إلى 74 عام) و 100 متطوع كمجموعة تحكم (54 من الرجال و 46 من النساء, تتراوح أعمارهم من 31 إلى 69 عام) , تم إجراء تحليل تروبونين تي بواسطة Elcysys 2010 وهو بروتين يفرز من عضلة القلب , كما تم إجراء تحليل الدهون في الدم لمعرفة علاقتها بارتفاع

التروبونين . تم تشخيص حدوث احتشاء عضلة القلب بواسطة التخطيط الكهربائي (ECG). وجد ارتفاع معتبر في مستويات التروبونين والدهون العالية الكثافة في عينات المرضى , كما وجدت علاقات ذات دلالات إحصائية بين مستويات التروبونين وكل من الكوليستيرول الكلي والدهون المنخفضة الكثافة وخلصت الدراسة الي وجوب التعاطي مع مرض ارتفاع ضغط الدم على الوجه السليم لتأثيره المباشر على عضلة القلب .

KEYWORDS: Cardiac troponin T, Hypertension, Lipid profile, Myocardial infarction,.

INTRODUCTION

Cardiac troponin T (cTnT) and troponin I (cTnI) are cardiac regulatory proteins that control the calcium mediated interaction between actin and myosin. The cardiac forms of these regulatory proteins are coded by specific genes and theoretically have the potential of being unique to the myocardium. Indeed cTnI has not been identified outside the myocardium. Cardiac troponin T is expressed to a small extent in skeletal muscle; however ,the cTnT assay does not identify skeletal troponins⁽¹⁾. Myocardial infarction (IM) or acute myocardial infarction (AMI) ,commonly known as a heart attack, is the interruption of blood supply to a part of the heart, causing heart cells to die. This is most commonly due to occlusion (blockage) of a coronary artery following the rupture of a vulnerable atherosclerotic plaque, which is an unstable collection of lipids (fatty acids) and white blood cells (especially macrophages) in the wall of an artery. The resulting ischemia (restriction in blood supply) and oxygen shortage, if left untreated for a sufficient period of time, can cause damage or death (infarction) of heart muscle tissue (myocardium)⁽²⁾ . Classical symptoms of acute myocardial infarction include sudden chest pain (typically radiating to the left arm or left side of the neck), shortness of breath, nausea, vomiting, palpitations, sweating, and anxiety (often described as a sense of

impending doom)⁽²⁾. Women may experience fewer typical symptoms than men, most commonly shortness of breath, weakness, a feeling of indigestion, and fatigue. Approximately one quarter of all myocardial infarctions are "silent", without chest pain or other symptoms⁽³⁾. Among the diagnostic tests available to detect heart muscle damage are an electrocardiogram (ECG), echocardiography, and various blood tests. The most often used markers are the creatine kinase-MB (CK-MB) fraction and the troponin levels. Immediate treatment for suspected acute myocardial infarction includes oxygen, aspirin, and sublingual nitroglycerin⁽⁴⁾ . Heart attacks are the leading cause of death for both men and women worldwide⁽⁵⁾. Important risk factors are previous cardiovascular disease, older age, tobacco smoking, high blood levels of certain lipids (triglycerides, low-density lipoprotein) and low levels of high density lipoprotein (HDL), diabetes, high blood pressure, obesity, chronic kidney disease, heart failure, excessive alcohol consumption, the abuse of certain drugs (such as cocaine and methamphetamine), and chronic high stress levels^(6,7). A raised cardiac troponin concentration is not just confined to myocardial injury from coronary plaque rupture or occlusion (primary ischemic myocardial injury). Indeed, cardiac troponins are also raised in, and have been shown to be of

prognostic importance in many other conditions associated with secondary ischemic injury, such as coronary intervention and spasm, cardiac arrhythmias, large pulmonary emboli, heart failure caused by idiopathic dilated cardiomyopathy, hypertrophic cardiomyopathy and in conditions causing non-ischemic myocardial injury, such as myopericarditis, septicemia, cardiac trauma, and chemotherapy⁽⁸⁾. Cardiac troponins are also raised in and are of prognostic importance in some patients with renal failure although many such patients do not present with pain that is typical of myocardial ischemia. There is currently no evidence that increases in cardiac troponins in patients with renal failure represent a “false positive” result, however, the precise mechanism for raised cardiac troponin concentrations in this group of patients is uncertain. It remains unclear whether raised troponins outside the clinical context of acute coronary syndrome are representative of reversible or irreversible myocardial damage⁽⁹⁾. It has been demonstrated that testing for troponins on admission and again after 6 to 12 hours provides better risk stratification than previously used algorithms based on the ECG and creatine kinase MB. The test results should be available within 30 to 60 minutes, because elevated troponins are helpful in identifying the patients who benefit most from early invasive strategies, glycoprotein IIb/IIIa antagonists, and low-molecular-weight heparins⁽¹⁰⁾. Dyslipidemia is a well-established risk factor for the development of coronary artery disease (CAD), and this has been demonstrated in several clinical and epidemiological studies. High plasma low-density lipoprotein (LDL-C) concentrations are directly correlated with the development of coronary artery

disease, and low high-density lipoprotein (HDL-C) concentrations have been pointed out as one of the strongest independent risk factors for coronary atherosclerotic disease. New evidences show that mild increases in triglycerides lead to increased risk of coronary events and progression of coronary artery disease, as well as to the formation of new lesions⁽¹¹⁾.

PATIENTS and METHODS

This study was conducted in El-shaab teaching hospital and Sudan heart center in Khartoum, where the medical assessment by medical doctors, and sample collection were carried during the period from January 2011 to January 2012. A total of 100 Sudanese hypertensive patients were selected as the study group (59 males, 41 females) their age 26 – 74 years, and another hundred apparently healthy subjects were selected as the control group (54 males, 46 females) their age 31 – 69 years. Clinical data, such as heart disease or renal disease, was obtained from the patient’s history and recorded on a pre-prepared questionnaire. Hypertension was measured as repeated blood pressure > 140/90 mmHg or pervious treatment with antihypertensive drugs. An ECG was done by experience doctors and nurses for all patients to identify MI. After informed consent, 5ml venous blood sample were collected from the volunteers and centrifuged within 20 minutes after collection at 3000 rpm for 5 minutes. The obtained sera were stored at -20°C until analysis. The serum was allowed to reach the room temperature before analysis. Determination of serum cTnT performed on the Elecsys 2010 system (Boehringer Mannheim). Laboratory evaluation included data regarding the levels of total cholesterol (TC), HDL cholesterol (HDL-C), and triglycerides (TG), as determined using the

enzymatic method; LDL cholesterol (LDL-C), using the Friedewald formula⁽¹²⁾.

Statistical analysis

Computer software of Statistical Package for Social Science (SPSS) version 17 was used for data analysis. The mean and standard deviation of the serum levels of troponin t and lipid profile were calculated and student *t*-test was used for comparison. Independent sample T-test was used to calculate P value. Analysis of case-control data was performed using the Chi-square test with $P < 0.05$ considered significant.

RESULTS

As depicted in (Table1), there was a significant increase in the levels of troponin T (P. value=0.001) and HDL cholesterol (P.value=0.001) in hypertensive patients as compared to those in the healthy controls. On applying Pearson's correlation, in hypertensive patients there was significant correlation between Troponin T and total Cholesterol (P value= 0.001, R = 0.341) (Figure 1), Troponin T and LDL-C (P value =0.002 ,R = 0.309) (figure 2) and no significant correlation was found between troponin t and HDL-C (P value= 0.766, R= 0.030) as shown in (figure 3).

Table 1: Serum Troponin T, Cholesterol, HDL-C, LDL-C and Triglycerides in hypertensive (patient group) compared to Non hypertensive (control group).

variable	Hypertensive (patient)	Non hypertensive (control)	P value
Troponin T (µg/dl)	.2288±.63272 (.00-4.25)	.0187±.01236 (.00-.05)	0.001
Cholesterol(mg/dl)	169.25±47.794 (72-300)	180.37±33.723 (100-273)	0.060
HDL-C (mg/dl)	45.5346±9.62144 (25.60-67.40)	54.2210±8.53025 (37.00-81.30)	0.000
LDL-C (mg/dl)	90.9031±43.45238 (13.41-197.76)	91.2314±29.70221 (26.60-182.60)	0.950
Triglyceride(mg/dl)	169.47±68.52849 (50.60-475.10)	171.16±71.68139 (65.00-430.00)	0.865

- Independent sample T- test was used to calculate P value
- P value less than 0.05 consider significant
- Mean ± Standard deviation
- Minimum – Maximum between the bracket

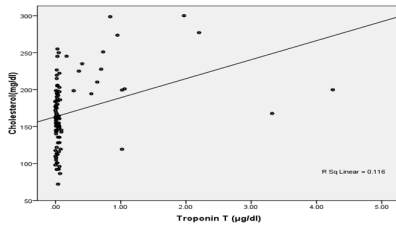


Figure 1: A scatter plot shows the correlation between troponin T and cholesterol in hypertensive patients. P value 0.001 R = 0.341

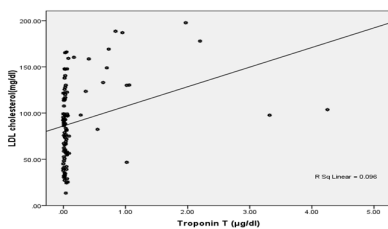


Figure 2: A scatter plot shows the correlation between troponin T and LDL-C in hypertensive patients. P value 0.002 R = 0.309

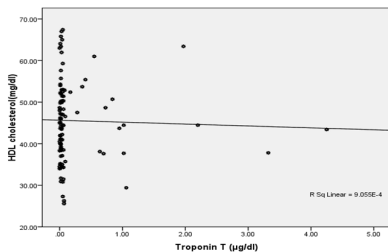


Figure 3: A scatter plot shows the correlation between troponin T and HDL-C in hypertensive patients. P value 0.766 R = 0.030

DISCUSSION

In line with previous studies, we found a significant rise in the levels of troponin T and HDL cholesterol in hypertensive patients. Elevation of troponin t may indicate that the extent of it is proportional to the size of the infarct and the severity of the coronary artery damage which were very important in hypertensive patients. This agree with study done by Setsuta

K, Kitahara Y, et al. They found that cTnT is a novel and useful predictor of future cardiovascular or cerebrovascular events in hypertensive patients⁽¹³⁾. One of the functions of HDL-C (good cholesterol), is to remove excess cholesterol, transporting this lipoprotein to the liver for reprocessing or excretion. To prevent cardiac disease, HDL-C levels should remain up and if below recommended range, steps are prescribed to raise the HDL-C concentration⁽¹⁴⁾. This relationship is supported by the potential antiatherogenic properties of HDL-C, including its mediation of reverse cholesterol transport, in which cholesterol from peripheral tissues is returned to the liver for excretion in the bile⁽¹⁵⁾. We found a positive correlation between Troponin t and total Cholesterol, which was statistically significant. Similarly, a positive correlation between troponin t and LDL-C found, to be statistically significant. A positive correlation between the atherogenic lipid profile parameters and troponin t clearly indicated the role of the latter in the development of atherosclerosis. This agree with study done by Holvoet et al⁽¹⁶⁾, they said that low-density lipoprotein (LDL-C) is released into the blood stream from disrupted or unstable atherosclerotic plaques, which may cause unstable angina or myocardial infarction. Elevation of cardiac markers lead to acute coronary syndrome⁽¹⁷⁾.

Dyslipidemia/hypercholesterolemia lead to cardiac event¹². In conclusion ; troponin t can be used as a predictor for the early detection of cardiac events along with the lipid profile markers in the general population, to prevent the mortality and morbidity which are associated with

hypertension. This agree with Holvoet et al⁽¹⁸⁾. They showed same results.

CONCLUSION

Cardiac troponin T can be used as a predictor for the early detection of cardiac event along with the lipid profile markers in hypertensive patients to prevent the mortality and morbidity which are associated with hypertension.

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