Troponin I level changes following diagnostic coronary angiography

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Received:, 2018; Accepted: 2018; Published: September 1, 2018
Citation: Melika Kooshkiforooshani, Kamyar Amin. Troponin I level changes following diagnostic coronary angiography. World Family Medicine. 2018; 16(9): 13-17. DOI: 10.5742MEWFM.2018.93489

Abstract

Background: There is evidence that cardiac biomarkers may rise after coronary angiography. We decided to determine elevated cardiac troponin I (cTnI) after coronary angiography in patients with normal coronary artery or < 50% stenosis. In addition, association of cTnI elevation with conventional CAD (coronary artery disease) risk factors was investigated.

Materials and Methods: A total of 280 patients with normal baseline CTnI level and normal coronary angiography or mild stenosis (defined as less than 50% stenosis) were included. Serum CTnI level was measured by ELISA method at baseline and once more during 6 to 24 hours after coronary angiography. Normal serum cTnI was < 1.3 ng/mL. In all patients, 6 French catheters were used and the contrast media was Ultravist with osmolality of 328 mOsm/kg.

Results: Elevated post-procedural CTnI was documented in seven patients (2.5%) with a mean value of 1.9 ng/mL (1.45 to 2.2 ng/mL). None of the patients experienced chest pain, dyspnea, arrhythmia, malignant hypertension, or ECG changes. There were more patients with male gender (4.9% vs. 0.6%), diabetes mellitus (6.3% vs. 0.5%), chronic kidney disease (20% vs. 1.1%), and obesity (8.9% vs. 1.6%) in the elevated cTnI level group than those who did not experience troponin rise (P< 0.01). All elevated cTnI group patients were hypertensive.

Conclusion: Serum cTnI level can elevate after coronary angiography in a small percentage of patients with mild CAD. Male gender, diabetes mellitus, hypertension, obesity, and chronic kidney disease were factors associated with this elevated cTnI level.

Key words: Troponin; coronary; angiography

Introduction

Cardiac troponin I (cTnI) is a specific marker for myocardial injury. It has better sensitivity and specificity over creatine kinase (CK) for myocardial injury (1). Troponins are structural proteins that are released into the bloodstream as a result of myocyte membrane disruption caused by myocardial injury (2). Hence, these markers are used for both diagnostic and prognostic purposes in acute coronary syndrome (ACS) (3).

Under normal condition, cardiac troponins are not present in the bloodstream. In addition to myocyte injury, cardiac troponins may increase in some other conditions such as skeletal muscle damage and heart failure (2). Another important condition where cardiac troponins can rise is following interventional cardiac procedures. There is evidence that peri-procedural troponin rises (1, 4-7). This post-procedural rise is important as it can reflect two conditions, namely myocardial infarction or myocardial necrosis due to the procedure itself (2). Most studies have emphasized on troponin rise after percutaneous coronary interventions (PCI) with an incidence of 10 to 40% (8). In a meta-analysis of more than 7,000 patients, MI was found in 15% of patients after PCI and this was associated with a higher rate of adverse events at 18 months follow-up (9). This was confirmed in another meta-analysis on 22,000 patients where increased cTnI was documented in 34% of patients whose all-cause mortality was significantly higher compared to other patients who did not have cardiac troponin rise (1).

Limited studies have been performed regarding cardiac troponin rise after coronary angiography. In a study on 12 patients younger than 21 years who underwent cardiac catheterization (mostly angiography), elevated cTnI was observed in 79% of patients immediately after catheterization and just two patients had myocardial injury (10).

As there is limited data about cardiac troponin rise after coronary angiography and the fact that this procedure is one of the most widely used procedures in diagnosis of coronary artery disease (CAD), we intended to determine the prevalence of cTnI rise after coronary angiography and related electrocardiographic and clinical variables.

Materials and Methods

In this cross-sectional study conducted from 2013 to 2015 at our university hospital cardiology department, 280 patients who underwent coronary angiography (left and right) and were found to have mild CAD were included consecutively. Inclusion criteria were normal CTnI level at baseline, normal coronary angiography or mild stenosis (defined as less than 50% stenosis in coronary arteries which did not cause hemodynamic disturbances at regular activities). Those with elevated baseline CTnI or other cardiac markers, or occurrence of adverse events (coronary artery dissection or rupture, emboli) during angiography, left ventricular ejection fraction (LVEF) < 40%, myocardial infarction (MI) during the last 2 weeks, stent placement requirement during angiography, cerebrovascular accident after angiography, and coronary spasm of more than 1 minute, were excluded.

Before angiography, serum cTnI level was measured by ELISA method (Monobind kit). Once more in 6 to 24 hours after angiography, serum cTnI level was assayed. In patients who showed elevated post-procedural troponin rise, its level was assayed for the second time in less than 24 hours. Normal serum cTnI was ≤ 1.3 ng/mL.

The gathered variables included age, gender, body mass index (BMI), systolic and diastolic blood pressure, serum lipid profile (total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglyceride), chronic kidney disease, conventional CAD risk factors (hypertension, hyperlipidemia, diabetes mellitus (DM), and smoking), serum creatinine, and angiography-related variables (the volume of contrast media, duration (time interval from catheter introduction to femoral artery to its removal), and number of views).

Statistics

The descriptive indices including frequency, percentage, median (range), mean and its standard deviation (SD) were used to express data. In order to compare nominal variables between the two groups, the Chi-square test or the Fisher's exact test was used. Significance level was set at 0.05. All analyses were performed using SPSS software (ver. 16.0, IBM).

Ethics

The study protocol was fully supported by the Research Council Ethics Committee of our medical university. The study objectives were explained to the patients and they were asked to provide written consent for enrolment. The study was in conformity with the Declaration of Helsinki.

Results

There were 120 (43%) male and 160 females (57%) with a median age of 58 years (range, 38 to 65 years). Mean (range) systolic and diastolic BP values were 135 (115 to 155) and 85 (60 to 95) mmHg. Mean (range) BMI value was 28.5 (23.5 to 34) kg/m^2. Thirty-three patients were obese (BMI > 30 mg/m^2). Table 1 presents frequency distribution of conventional coronary artery disease (CAD) risk factors. Twenty patients had CKD. Median (range) of total cholesterol, HDL, LDL, and triglyceride levels were respectively 230 (175-280), 38 (30-48), 135 (90-195), and 210 (185-310) mg/dL.

Table 1: Frequency of conventional coronary artery disease (CAD) among 280 patients who underwent coronary angiography

Variable	N (%)
Hypertension	126 (45%)
Hyperlipidemia	64 (22.8%)
Cigarette smoking	59 (21%)
Diabetes mellitus	95 (34%)
Family history of CAD	22 (7.8%)

In all patients, 6 French catheters were used and the contrast media was Ultravist with osmolality of 328 mOsm/kg. Coronary spasm occurred in 20 patients (7.1%). Table 2 presents coronary angiography-related variables.

Table 2: Coronary angiography-related variables among 280 patients who underwent coronary angiography

Variable	Median (range)
Angiography duration, minutes	8 (6 to 15)
Contrast agent volume, mL	35 (15 to 55)
Number of catheters	2.2 (2 to 4)
Number of views	5 (4 to 9)

Elevated post-procedural CTnI was documented in seven patients (2.5%) with a mean value of 1.9 ng/mL (1.45 to 2.2 ng/mL). None of the patients experienced chest pain, dyspnea, arrhythmia, malignant hypertension, or ECG changes. Characteristics of seven patients who experienced elevated cTnI

There were more males in this group (6 males, 86%) in comparison to those who did not have elevated cTnI levels. About 4.9% of males experienced cTnI elevation which was significantly higher than females (0.6%) (P< 0.01). Of seven patients who experienced elevated cTnI, four subjects (57%) had CKD and three cases were under hemodialysis. In other words, 20% of patients with CKD experienced elevated post-procedural cTnI elevation, but, only 1.1% of patients with normal renal function experienced elevated cTnI elevation (P< 0.01). Also, of seven patients, six had DM (86%). The percentage of diabetics who had elevated cTnI level after angiography (6.3%) was significantly higher than in non-diabetics which was 0.5% (P< 0.01). About 8.9% of obese patients had elevated cTnI and this figure was significantly higher than in non-obese patients (1.6%); P< 0.01. Mean duration of DM in those who had elevated cTnI was six years which was similar to non-diabetic subjects. All seven patients had hypertension. None of them were smokers. Mean LDL, contrast media volume, angiography duration, number of catheters, and number of views were respectively 150 mg/dL, 30 mL, 9 minutes, 2.5, and 5 in this group and was comparable to those who did not have cTnI elevation. None of the patients in this group had coronary spasm.

Discussion

Coronary angiography is one of the most widely used diagnostic methods for diagnosis of CAD and risk stratification and treatment planning. Cardiac troponin rise after percutaneous cardiac catheterization can occur due to several factors and this rise can be worrisome as this may reflect myonecrosis. According to the presented findings, a small number of patients (2.5%) experienced post-coronary angiography cTnI level elevation. The reported incidence of elevated cardiac biomarkers after PCI has a wide range from 1% to 30% (9). Cardiac troponins are the most widely used in different studies owing to the sensitivity and specificity of troponins for myocyte injury. The term PCI-related MI is an established diagnosis and is described as a three-time elevation of troponin of the upper reference limit (11). None of the current patients fulfilled this definition for MI.

Troponin level rise after PCI (25 to 34%) (1) is much higher than what we observed here. Unfortunately we were not able to follow the patients to find any association between elevated cTnI level and prognosis. However, Post-PCI troponin level increase has been demonstrated to associate with all-cause mortality (1). However, there is conflicting data about to what extent measuring troponin changes and its elevation can predict long-term prognosis (5).

We found that patients who experienced elevated cTnI after coronary angiography were more likely to be male, hypertensive, diabetic, and have CKD. However, it should be considered that troponin rise after cardiac catheterization is a multifactorial phenomenon. Here, we included patients who were candidates for non-emergent diagnostic angiography and excluded heart failure patients. In previous studies, heart failure, CAD, and the requirement for urgent interventions were described as factors that are most likely to be associated with post-procedure troponin rise (12). Another important contributor to this finding is development of adverse events (vessel rupture and thrombus formation) that can cause troponin elevation (1, 6).

Whether routine measurement of troponin levels when diagnostic angiography of the coronary arteries should be made or not is still questionable. Even routine troponin measurement after PCI is not agreed on all experts (13). In contrast, there is evidence that even microleak of troponins should not be ignored and routine measurement of troponins should be made in all patients (7).

We recommend that further studies include more patients and to follow them for a longer time to find any association between elevated cTnI level after angiography and development of CAD and mortality. In addition, more interventional studies can be performed regarding some interventions that have been suggested about protective role for myonecrosis such as statins, for better understanding of this association (1).

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Conclusion

Serum cTnI level can elevate after coronary angiography in a small percentage of patients with mild CAD. Male gender, diabetes mellitus, hypertension, obesity, and chronic kidney disease were factors associated with this elevated cTnI level.

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